SCIENTIFIC AMERICAN

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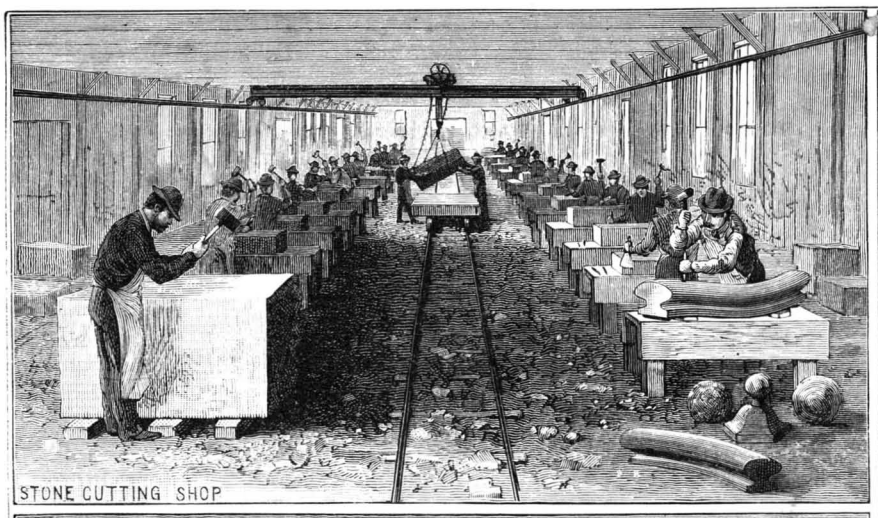

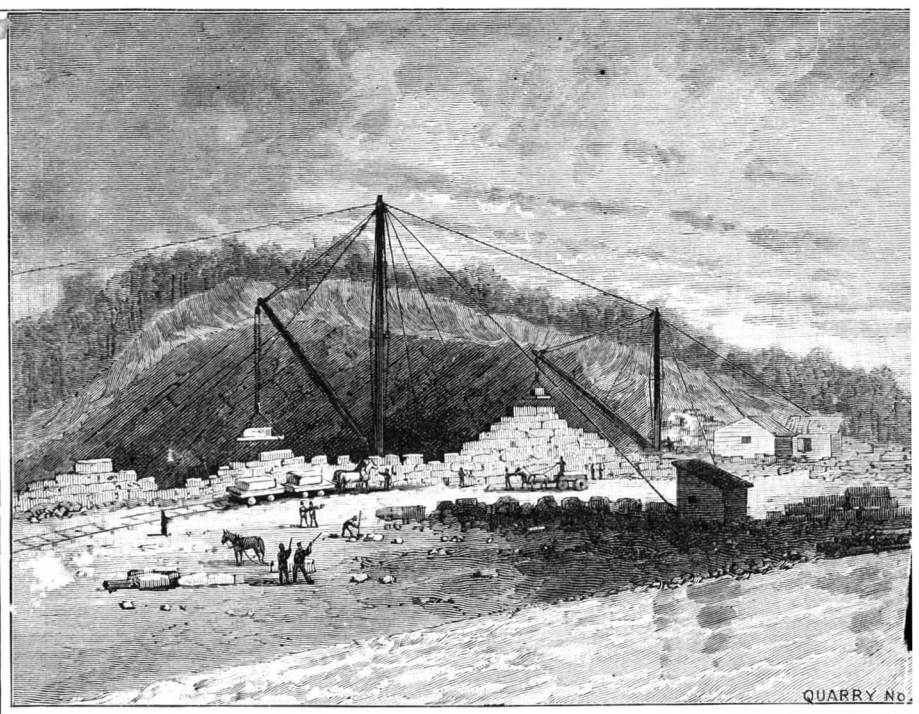

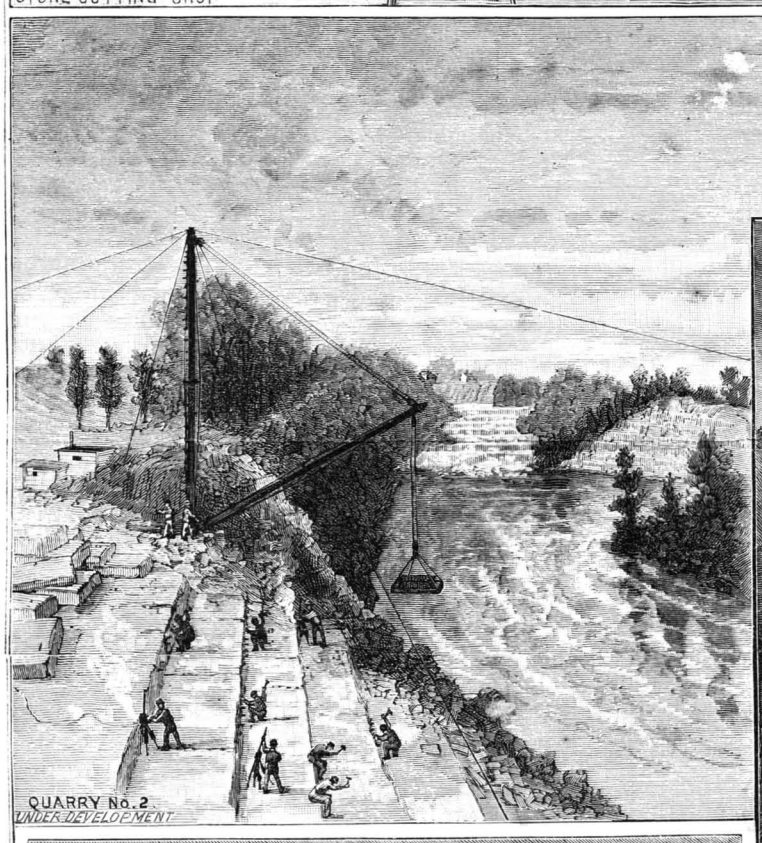

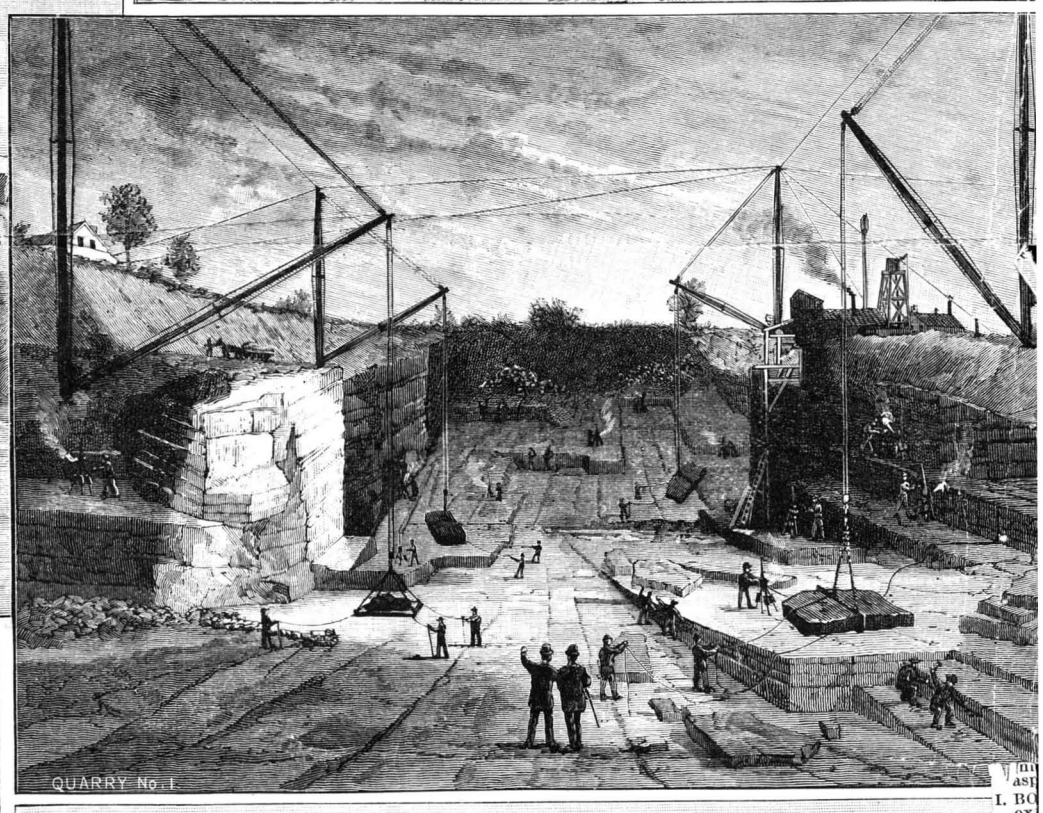

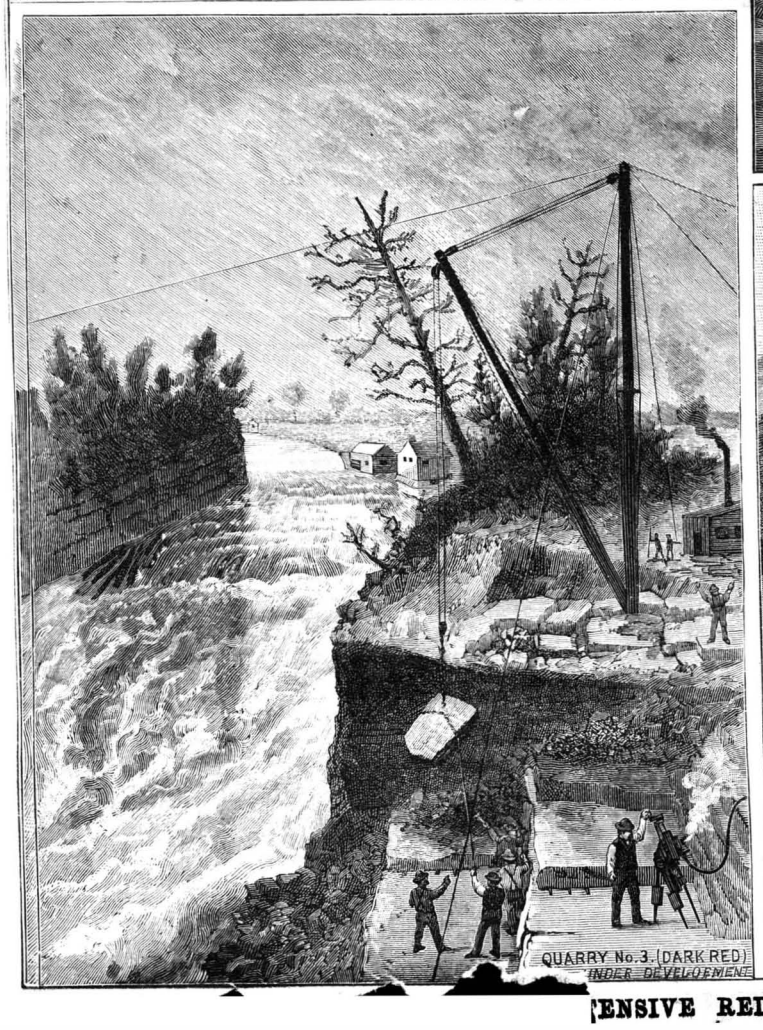

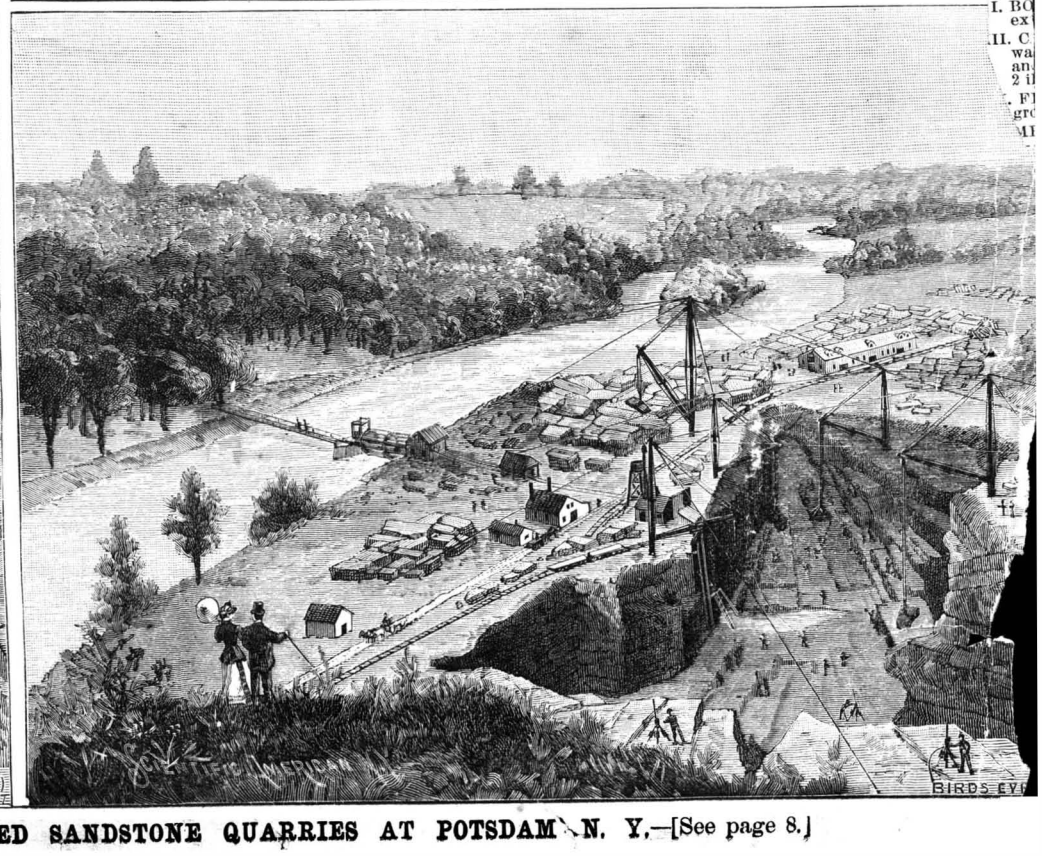

EXTENSIVE RED SANDSTONE QUARRIES AT POTSDAM, N. Y.—[See page 8.]

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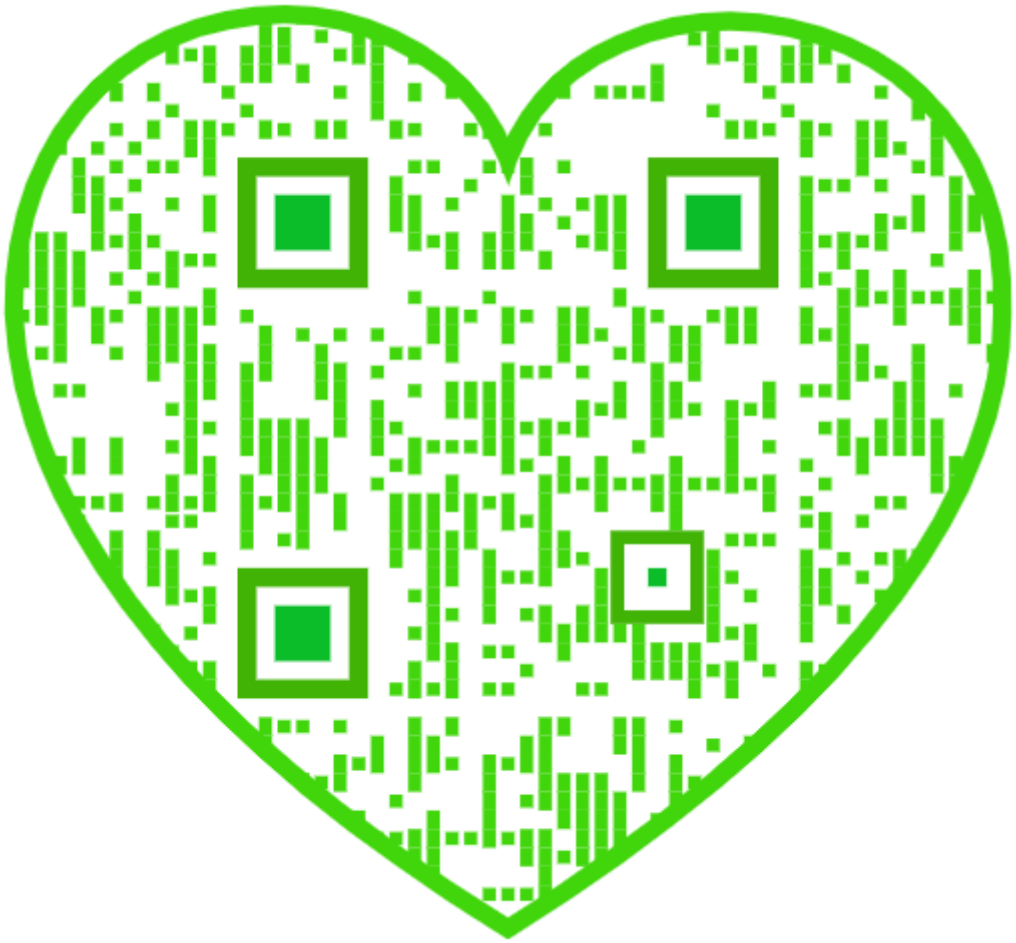

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SAFETY SUGGESTIONS FOR OCEAN STEAMERS.

Considerable anxiety prevailed in this city during the past week owing to the non-arrival of the British fast mail steamship Umbria, of the Cunard line, plying between New York and Liverpool. The apprehensions for her safety were considerably relieved by the arrival of another vessel that reported having seen and signaled the missing steamer at sea. The Umbria was then under sail, 750 miles distant from New York, and signaled that she was disabled, but required no assistance. From this it was assumed her machinery was out of order and repairs were in progress.

The large and splendid German steamship Spree lately met with a serious disaster, due to the breaking of her propeller shaft. Ragged parts of the machinery broke a hole in her after compartment, which soon filled with water, and the great vessel was left helpless, to drift upon the waves. Fortunately her compartment bulkheads remained tight, and her signals of distress were seen by another steamer, which took her in tow and finally brought her into port.

The accident which occurred to the double propeller ship City of Paris a few months ago will, doubtless, be remembered by most of our readers. In this case one of the propeller shafts broke down and the flying fragments of iron broke through the bottom of the ship, and also through the longitudinal compartment bulkhead of the adjoining engine room, so that the water quickly filled both engine compartments, disabled both engines, and left the vessel helpless. A double propeller ship had been previously regarded as particularly safe; it was reasoned, if accident happened to one set of machinery, the remaining engine and propeller could drive the vessel at nearly normal speed. The futility of such expectations was well illustrated in this particular case.

The question whether all reasonable means of securing the safety of ocean steamers in case of accident are at present made available is an interesting one. We think they are not, and that much might still be done, without material augmentation of weight or expense in the fitting up of the vessels. We will make a few simple suggestions.

Nearly all steamers of the class mentioned are provided with a number of independent donkey engines, boilers, and pumps. It seems as if it would not be a difficult matter to carry pipes to bow and stern, and arrange suitable connections with the pumps, so that in the event of accident to the main propelling machinery, the various streams of water could be joined and used to propel the ship, the same as now practiced on jet-propelled vessels. With a proper arrangement of jet pipes, the vessel could then be readily steered in case of breakage of the rudder, and kept head to wind if the engines were disabled. It is also probable that, by a simple attachment, the main engines and boilers might be used for jet propulsion, in case of loss of the propeller blades, which is not an uncommon accident, as we all know.

We have in our back volumes several times illustrated the construction and operation of jet-propelled boats. The method is simple, practical, and successful; but as yet it has not been made equal in speed or economy to the ordinary propeller, and hence is not in general use.

It has, however, been successfully applied to life boats, and a fine example is seen in the English steam life boat Northumberland, which is now in active service in England. An engraving of this little vessel, with particulars, will be found in the SCIENTIFIC AMERICAN of September 6, 1890.

As applied to life boats, one of the particular advantages of the jet system is that there is no projecting propeller to be injured or fouled by ropes, or by pounding on sands or wreckage.

The Northumberland pushes out against fierce breakers with the utmost facility, and is not only propelled, but readily steered by means of her water jets.

In addition to the supply of jet pipes to ocean steamers as above indicated, it would seem as if these vessels might also be furnished to advantage with one or more steam life boats such as the Northumberland.

The suggestions here made apply not only to ocean passenger vessels, but to war ships. Every one of the boats of our new navy ought to be fitted with jet steering and propelling pipes. In the event of battle the disablement of rudder or engine leaves the ship a helpless target before the enemy's guns. The addition of the simple means here indicated would enable them to turn quickly into any desired position, even if engines and rudder were broken, and thus to stand up against the foe.

The Coming of Columbus' Ships.

Orders have been issued by the Navy Department to Rear Admiral Benham, commanding the European squadron, for his flagship Newark and the gunboat Bennington to convoy the Columbian caravels Pinta and Nina from Spain to the United States by way of the West Indies.

The Newark is now at Smyrna and the Bennington is at Cadiz. The former will visit Naples to receive the Vatican exhibits, Marseilles to receive the French Columbian relics, and will then proceed to Cadiz to assist in fitting out the caravels for their voyage across the Atlantic over the original course taken by Columbus. The caravel Santa Maria, representing the discoverer's flagship, will be sent over separately by the Spanish government, but will join the other vessels at Havana.

The entire fleet is to start from Cadiz not later than February 15, so as to insure its arrival here in time to participate in the Columbian naval review at Hampton Roads next May.

The Medical Uses of Compressed Gases.*

BY CLEMENT B. LOWE, PH.G., M.D.

Within a comparatively recent period there has been introduced to the notice of the medical profession the use of compressed gases, the principal ones now being used in this way being oxygen and nitrogen monoxide (formerly known as nitrous oxide, or laughing gas).

The medicinal properties of both of these gases have been known for many years. Experiments made upon animals have shown that the inhalation of oxygen produces no injurious effects, but the reverse; they gain in body weight through the stimulating effects upon the nutritive functions, these results being produced mainly by the effects of oxygen upon the blood through the increase and stimulation of the red corpuscles. The effects thus produced upon animals have been verified by numerous cases reported by physicians of prominence. The chief diseases in which it is indicated are diseases of the respiratory organs, characterized by difficulty in breating, such as asthma, croup, etc., also in the early stages of phthisis pulmonalis; in chronic indigestion, and especially in asphyxia from poisonous gases, such as carbon monoxide, etc. In the latter case its use may be invaluable; for instance, a person has been found insensible from the inhalation of carbon monoxide produced by imperfect combustion in a stove in a bed chamber. If the carbon monoxide has not been present in sufficient amount to saturate all of the hæmoglobin of the red corpuscles of the blood, recovery takes place, *but very slowly*, it being weeks or months before the patient is restored to normal health. In such a case the inhalation of oxygen would be of the greatest valve, the hæmoglobin being at once changed to oxyhæmoglobin and the blood in the arteries being restored to its bright scarlet color.

The anæsthetic properties of nitrogen monoxide were discovered by Sir Humphry Davy. It was first used in dentistry by Dr. Wells, of Hartford, Ct., and more recently as a remedial agent by some of the most eminent physicians of the country, Dr. J. E. Blake and A. McLane Hamilton being prominent among them. It is also being extensively used by medical quacks under the name of compound oxygen. It should be stated that in many cases the latter gas has given better results than those from oxygen. It is stated that one of the best known of New York City physicians has used more than 20,000 gallons of nitrogen monoxide in his practice during the past two years, chiefly in the treatment of nervous diseases. He regards it as a sheet anchor in nervous prostration, insomnia, melancholia, etc.

While, as before stated, the use of these gases therapeutically is not new, the use of them in a compressed form is more recent, as previous to the use of the apparatus devised by the S. S. White Dental Manufacturing Company, of this city, which, through their courtesy, I shall have the pleasure of showing you this afternoon, oxygen had to be made by the physician himself, necessitating the use of expensive apparatus and the loss of valuable time. Even if procured from those who manufacture it for calcium lighting (with but one exception in this city), it would taste of illuminating gas (carbureted hydrogen), on account of the same pump being used to compress both gases.

As the use of these compressed gases shall become more frequent by the medical profession, pharmacists can add to their stock these cylinders, and be ready to supply them at a moment's notice as they would any other remedy, as is already done by a member of our college.

In using the apparatus the compressed gas is first conducted into a rubber bag or a metallic gas receiver, from the former of which it is inhaled under ordinary pressure, the gas passing through a bottle partly filled with water. If to be used as an enema, the gas is displaced from the receiver by water flowing from a can placed about 22 inches above the receiver, and is passed through a bottle, containing warm water, to the patient.

Nitrogen monoxide is used in the same way for inhalation, but when used as an anæsthetic, of course, the face piece as used by dentists should be employed.

NEW ARMY POST.—One hundred thousand dollars has been appropriated by Congress for new army post buildings near the city of Helena, in the County of Lewis and Clarke and State of Montana.

*Read before the pharmaceutical meeting of the Philadelphia College of Pharmacy. *Journal of Pharmacy.*

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American Ostrich Farming.

BY H. C. HOVEY.

Tame ostriches have long been kept as curiosities; but ostrich farming dates no further back than 1866, when the breeding of these splendid birds for industrial purposes became necessary, in order to prevent their extermination. Formerly abundant in Asia, the wild ostrich is now rarely found on that vast continent, except in parts of Persia. In Africa it used to range in great herds from Algeria to Cape Town; but so remorselessly has it been hunted for its plumage, as well as for the excitement of the chase, that the market value of the undressed feathers ran up to $500 per pound. With such a price set on his head, the gigantic bird was doomed. The statistics of slaughter are not readily accessible; but, according to one authority, the annual importation of feathers from a single region would necessitate the killing of half a million ostriches. Stringent legislation was enacted, but not so easily enforced amid the African deserts. The honor belongs to the French Acclimatization Society of having first directed attention to the practicability of ostrich farming. Successful experiments were made at Algiers and at Cape Town. The new business grew so rapidly in favor, especially at the Cape, that the colony reported, at the end of the first decade, 32,247 domesticated ostriches; and by 1880 the number had increased to 100,000, with an investment of $40,000,000, and an annual yield of plumes worth more than $4,000,000.

Owing to the increased supply, together with the fluctuations in fashion, the plumes are less costly than formerly, yet the business is sufficiently remunerative to attract the attention of enterprising Americans. Ostriches were imported from Natal in 1882, 1883, 1886, and 1887, each bird having a separate padded box, and most of them making the voyage safely. They were landed at New Orleans and at Galveston; but the climate not being exactly favorable, they were taken overland to Southern California and Arizona. Among places where the experiments have been carried on may be mentioned Anaheim, Los Angeles, Carpentraria, San Diego, in California, and Phœnix, in Arizona. The writer visited several ostrich "pastures," but was particularly interested in the methods and success of the American Ostrich Company. The manager, Mr. E. J. Johnson, brought over the colony of parent birds, twenty-three in all, from Cape Town, in 1883, and after a careful inquiry into climatic and other conditions, located them in the sheltered valley of the San Luis Rey, seven miles from the town of Fall Brook, Cal. A branch farm was also established at Coronado Beach, under the care of Mr. J. R. Campbell, and another at Riverside, under Mr. H. Bentley. A large number of young birds have been successfully raised, three of which have gone to Honolulu, six to Denver, and others elsewhere, besides about a hundred still on hand.

The Fall Brook farm comprises about 380 acres, subdivided for the various uses indicated. The "hatchery" covers half an acre. Chicks three months old are turned into a field of twenty acres. At the age of six months they are promoted to a larger field of forty acres. The full-grown birds occupy a pasture of a hundred acres. When breeding, each pair is confined to a field 200 feet square. This is necessary, for the reason that the breeding birds are pugnacious and even dangerous. It is a curious fact that the female ostrich chooses her mate, and those once paired are paired for life. The males, however, do the fighting, both with each other for the supremacy of the ranch and also with unlucky intruders. Their manner of warfare is peculiar. They do not strike with the beak, but with the foot; always forward, never kicking, using right and left alike, and in rapid succession. Their aim is accurate, and it is said that they can strike with sufficent force to pierce an inch plank. They seem void of affection, even for the owner that feeds them from the time of hatching. Mr. Campbell, who has raised over a hundred ostriches, said that his birds would, at breeding time, attack him as soon as they would a stranger.

There are three breeding seasons a year. The male digs a nest in the sand, where the female deposits an egg every other day until from ten to twenty are laid. Then the obedient male bird takes the main care of the nest, sitting from 3 P. M. till 8 A. M., when the female sits till afternoon. Each nest is seven feet wide by three deep. A singular fact, not hitherto noted, is that the male, who sits at night, is black, while the female, who sits by day, is gray, each being adapted to its environment by color protection. After the chicks are hatched the male takes care of them, even to brooding over them at night. Occasionally he contrives to steal a few chicks from another male, and then there is a row. Indeed, there is so much jealousy and annoyance that many chicks have thus been lost. It has been found safer and more economical to hatch the eggs by the Petaluma incubator, which I had the pleasure of seeing in operation. The temperature must be kept at 101° Fah., day and night, for forty days. With the utmost care, only about sixty per cent of the eggs hatch out and about twenty per cent of the chicks die afterward. They are at first very sensitive to cold. At midday they are allowed to run about in the sunshine, but as night approaches, even in the equable climate of Southern California, they must be taken under cover. From the age of three months they are able to take care of themselves, unless a cold storm comes on; and they seem to be exempt from disease. No adults have died except from accident.

A full grown ostrich is a magnificent creature, weighing 250 pounds, and measuring five feet from the ground to the back, and ten feet to the head when erect. The hens, however, are less than these figures. The eggs weigh from three to three and a half pounds, and are always white. They are rather strong when boiled, but make an excellent omelette. Ostriches are notoriously voracious, and will greedily devour refractory substances if allowed to do so. But their main diet is corn, melons, fruit, and vegetables. They reject meat, insects, and all animal food, although taking a malicious joy in killing the young of poultry if they come within reach. Their method of destruction is grotesque. I saw one of them reach over a fence, and in defiance of a mother hen, pick up one of her brood, lift it aloft, hold it there for a while, and then let it drop. A few repetitions of the lifting and dropping were fatal, and this seemed to satisfy the persecutor. The ostrich has no gizzard, but takes his food directly into his capacious stomach. His feeding attitudes are unique. He first gathers as large a mouthful as possible; and then, lifting his head on high, lets the force of gravitation convey the load slowly down his long esophagus.

"Bromming" is the term applied to the unearthly sound that the ostrich imagines to be song. When I first heard it I actually mistook it for the trumpeting of a distant fog horn! In the desert it might well be a fit answer to the roar of the lion. So very peculiar is the sound, that I took pains to ascertain exactly how it was produced. The process, after all, is simple. The bird inflates his long neck, till it looks like a great bag; he then lets the air out again in three installments. He blows thus thrice in succession, making nine roars in all. The performance is then over for the time being. Bromming is occasionally heard by day, but more usually breaks the silence of the night, and is probably meant as a challenge. Two of the herd always are on guard while their companions sleep. They take turns in this duty.

Ostrich chicks are comical little fellows with downy heads and necks and striped bodies. The feathers are allowed to grow without being disturbed until maturity. The moulting time is in the fall, when all the best feathers would be dropped were they not previously plucked. This is not a very easy task in the case of such a powerful and pugnacious bird. One method is by driving the victims, one at a time, into a plucking box that restrains them from violent resistance. Another way is for an attendant to grasp the bird's head and forcibly draw it to the ground, in which position it cannot see to strike while being robbed of its plumage. The wing and tail feathers alone are plucked. Each bird yields from one to two pounds, worth from $50 to $250, according to quality. They are sorted at the farm and then sent to the manufacturer, who dresses them for the market. About one-fourth of the annual harvest finds sale in California, and the rest are disposed of in New York. The natural colors of the feathers of the male ostrich are pure black and spotless white; while those of the female are drab and white. The pure white is the most highly prized. The very finest are retailed in California at ten dollars a plume. The more common kinds shade down as low as one dollar each. Boas are also made of the black, white, and gray mixed, and sold at from $25 to $75 each. There is also a market for the eggs, which bring about two dollars apiece as curiosities.

In conclusion, while mistakes may have been made and losses incurred, the fact seems to be established that ostrich farming in America is an assured success. The birds, instead of degenerating in captivity and exile, thrive and multiply rapidly, and the plumes rival those of Natal or Barbary, and by more skillful breeding may yet compare with the wild feathers of the Sahara.

Decadence of Natural Gas.

There is hardly a doubt that the natural gas supply, even in the most favored districts where this agent has been discovered, is generally approaching extinction, and it will soon cease to be an important factor among the fuels of the country, particularly as far as its use in manufacturing industries is concerned. What were recently the most prolific fuels in Ohio have abated their yield to that extent that several factories dependent on natural gas for heat have had to introduce other fuels; some have ceased operations, and several are seeking locations in the more fruitful territory of Indiana. But, judging from experience elsewhere, the supply even in the last named State will not last so very long either; and furthermore the expense of sinking new wells and making the necessary connections with existing plants will cost so much as to preclude the possibility of continuous profitable use of the fuel. It must be allowed, however, that the decadence of the natural gas flow is not steadily progressive, even in the oldest territories whence the supply has been drawn. In this city (Pittsburg), for example, there is more to be had now than was afforded last winter; but the increase comes mostly from new wells, and, as noted above, there is a limit to the extension of this resource.

The gas companies, here and elsewhere, find that it is more profitable to them to furnish fuel to private consumers than to manufacturing establishments, and so they are curtailing the supplies of the latter, except in places where the gas is in great abundance.

In some industries the fact of the supply beingirregular does not cause such great loss, though, of course, that condition is always inconvenient. But for glass manufacture it is of paramount importance that the supply of fuel should be always steady and reliable. The cooling of a glass furnace, even temporarily, involves the destruction of the pots, not to speak of the other losses accruing from it, and after a furnace once becomes cold, it takes some time, even under the most favorable circumstances, to get it going again. So that to make glass successfully, the source of heat must be constant and always to be depended on, else continual loss and trouble are certain to ensue. There was never, perhaps, a better fuel for this manufacture than natural gas, from its cleanliness, universal applicability to all purposes, freedom from smoke and refuse, and easiness of adaptation to every description of plant and furnace. But since the first premonition of the decline in its supply and probable extinction, inventive men have been exercising their faculties in the endeavor to provide a fuel as nearly equal as possible in its advantages to natural gas, and if they have not succeeded entirely, they have come very near it; and wherever there is coal to be had a good substitute for natural gas can be obtained, and that without having to resort to the use of the former in its raw state, as was the case before the natural gas came in. Of course the cost of artificial gas will depend on the supply and quality of the coal in whatever locality it is needed, which vary considerably in different sections. Crude oil, too, has its advocates as a glass-making fuel, but while it has been successfully used in some places, the general results of its application have not been such as to inspire confidence in its value as an important adjunct for heating purposes in glass manufacture.—*Glass and Lamps.*

The Armour Institute, Chicago.

Philip D. Armour, the millionaire packer, started for New York December 12, on his visit to Europe, leaving behind him a Christmas gift of over $1,500,000 to the city of Chicago. Absolutely unknown to the public, work has been going on for a year past toward the erection of a magnificent five-story building on Armour Avenue, and it is now all but ready for occupancy. This building will be known as the Armour Institute, and will be to Chicago all that the Drexel Institute is to Philadelphia and the Pratt Institute to Brooklyn. This building is but a small part of the gift. In addition to it, and for its support, Mr. Armour gives $1,400,000. All that money and brains and labor can do will be done toward making it the greatest institute for manual training, science, and art in this country.

Mr. Armour conceived this idea years ago, and the plans have been carefully gone over with George W. Childs, John C. Black, and Mr. Armour's sons, Ogden and Philip. The building and the funds for the support are to be turned over to a board of directors. It is expected that the school will open on the 1st of next September. During the next few months the most complete apparatus obtainable for every branch and a library bearing upon every line of study will be secured. The building has been erected and is now being finished without regard to expense. In the basement will be placed the electric plant, and here will be located the students in forging and iron work. On the first floor is a library sixty feet square. Woodworking rooms and the rooms for reception and for the president of the institute are also located here. On the second floor are the chemical laboratory, the chemical lecture room, the physical laboratory, the physical apparatus room, the physical lecture room, and electrical rooms. The third floor will be used by students in free-hand drawing, mechanical and architectural drawing, and in commerce and business. The fourth floor is devoted to the domestic sciences, there being departments of cooking, dressmaking, millinery, and kindred studies. On this floor are also recitation, lecture, and class rooms. At one end of the fifth floor is the gymnasium, 60×53 feet. At the other end is the technical museum. Connecting the two are dressing rooms for the gymnasium and elaborate bathrooms fitted up in white marble. The faculty of the institute will be of the highest standing, and it is Mr. Armour's desire that students may have opportunities to be prepared for the higher universities, or practical work in any field of mechanical or scientific labor. Every possible convenience for scientific research and experiments will be provided. The institute is not located in a fashionable portion of the city, and Mr. Armour's idea in placing it where he has is said to be to put the institute among those whom it will most benefit.—*Press Telegram.*

THE atmosphere, if compressed, would make a sea thirty five feet deep around the globe.

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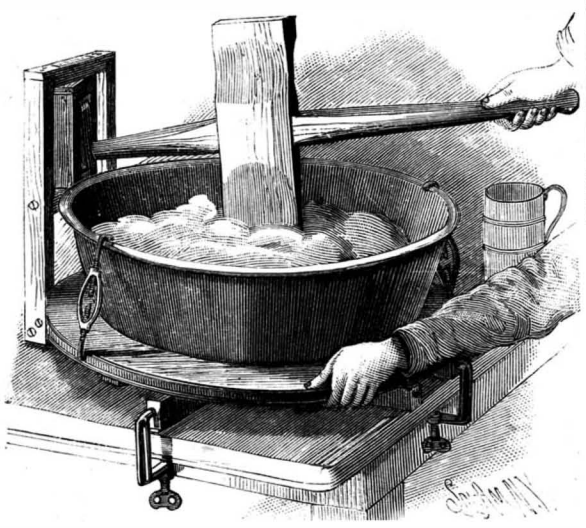
STONE'S FAMILY BREAD KNEADER.

A device designed to preclude the necessity of putting the hands into the dough in the process of mixing and kneading, and efficiently knead the dough with the least expenditure of strength, is illustrated herewith, and has been patented by Mr. D. G. Stone, of Negaunee, Mich. A horizontal frame is provided with a central vertical stud, and to one end of the frame is secured a vertical frame in which is mounted a block supported by trunnions, the block being apertured to receive another block supported by trunnions riding in bearings formed in the first block. Upon the horizontal frame is placed a circular table, having a central aperture to receive the vertical stud, upon which the table is free to turn, and which table, being removable, is used later as a bread board in the process of shaping loaves for the oven. To opposite sides of the table are secured removable hooks, adapted to engage the edges of a bread pan placed thereon, the hooks being provided with turn buckles by means of which the pan may be secured in place.



AN IMPROVED DOUGH MIXER AND KNEADER.

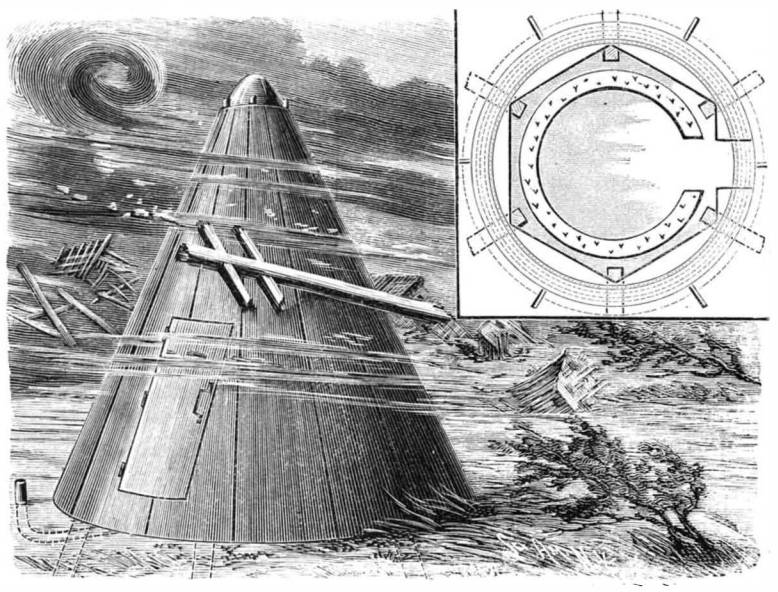
The combined mixer and kneader is supported by a lever having a handle at one end and a projection at the other end adapted to enter the central block in the vertical frame, the face of the mixer, which is shown in use in the illustration, being concavo-convex in cross section, while the kneader end of the implement is hollowed out in its body portion and has a flat, smooth face. The proper ingredients having been placed in the pan, the mixing is effected by reciprocating and turning the lever, revolving the table as desired, as the work proceeds, and when the kneading is to be done the lever is simply turned to bring the kneader into operative position, when the operation may be carried on continuously. The ease with which this usually tiresome labor may be performed by means of this device is designed to insure more thorough kneading, the object of kneading the dough being to break up into finer ones the bubbles of carbonic acid gas resultant from the fermentative action of the yeast, which bubbles have become entangled in the glutinous mass, and to distribute them evenly throughout the material. Thus it follows that the more thorough the kneading the more uniformly light and porous should be the bread.

For further information relative to this invention address the inventor as above.

THE meteors of Nov. 23, 1892, as seen by W. J. Hussey, at Palo Alto, Cal., did not come at a strictly constant rate, though nearly so. On the average, a single observer could see from 50 to 60 fairly bright ones every five minutes, which corresponds to a daily rate of from 400,000,000 to 500,000,000 on the hemisphere of the earth toward the radiant.

A BUILDING TO WITHSTAND CYCLONES, ETC.

A structure for use in countries where hurricanes and cyclones are liable to occur, and which will afford a secure temporary shelter during the heaviest storms, is shown in the accompanying illustration, and has been patented by Mr. Reuben Quatermass, of Moline, Kan. A number of posts are arranged in a circle and inclined to connect with each other at the top, forming a conical shell, the lower ends of the posts being firmly secured to horizontal anchor beams some distance below the surface of the ground. This framework is covered by a sheathing of heavy planks, the top layers of which are nailed one upon the other and shaped to form a rounded top, The plank covering extends a short distance below the ground, and this covering is metal-clad, making an earth connection for electrical currents, conducting wires also leading from the lower edge of the covering farther down into the ground. A heavy door, also covered by sheet metal, allows access to the interior, which is suitably floored, and, as will be seen by the plan view, is provided with a circular seat. In the top are a number of vertical ventilating pipes or tubes, and there is also an underground ventilating pipe, terminating in the outer air just outside the building, and affording an ample circulation of air within when the door is tightly closed. This building is designed to afford absolute protection against cyclones, tornadoes, and lightning, there being no danger of flying debris penetrating its walls or obstructing ventilation. Differing materially also from underground caves or vaults, it is not wet or damp, and is free from insects or reptiles, being always ready for occupancy, and forming a comfortable place of refuge for as long as any storm may last.



QUATERMASS'S CYCLONE BUILDING.

AN IMPROVED SIDE AND ROOFING TILE.

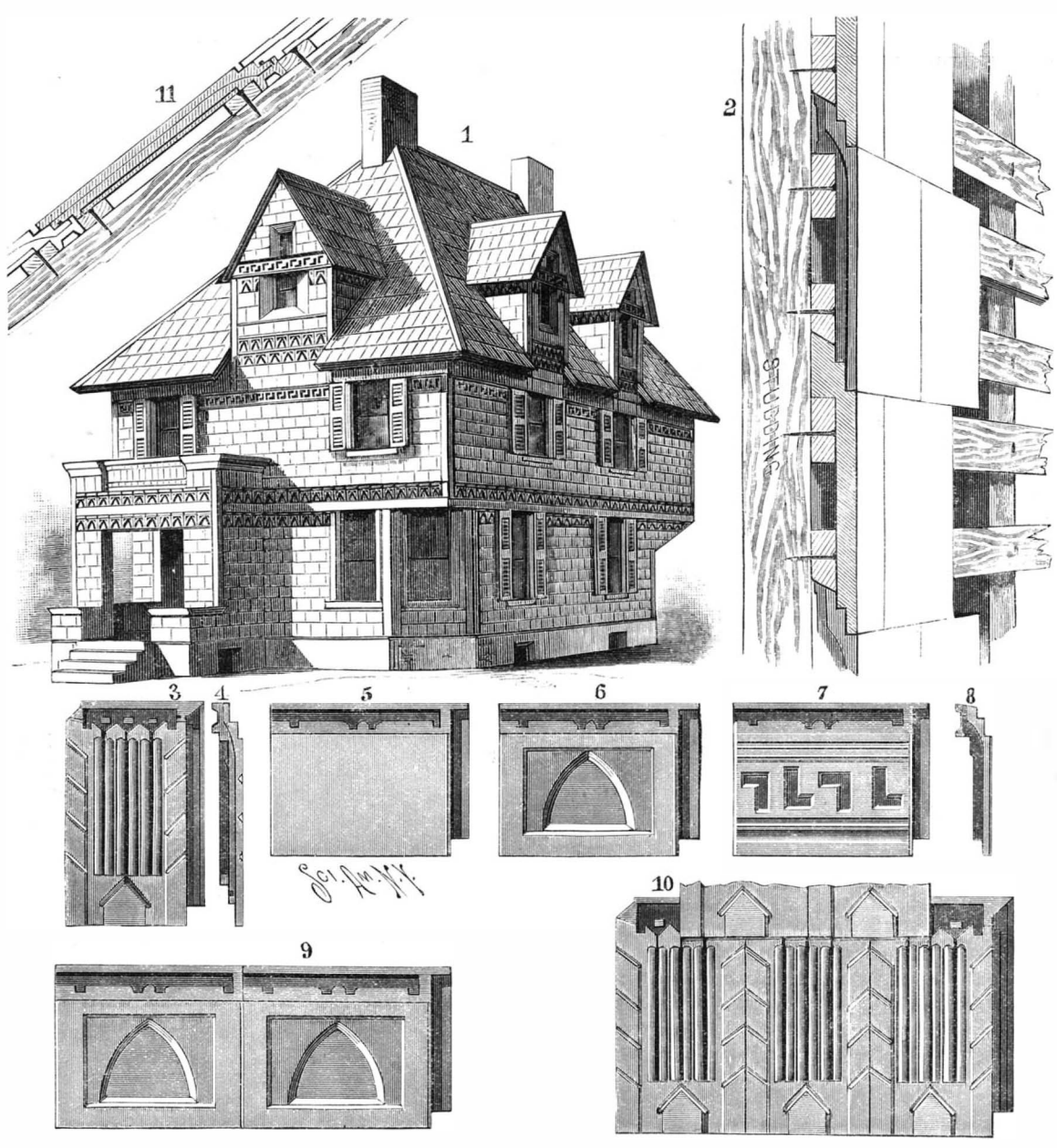
A house which is both sided and roofed by an improved form of tile, with details of the tiling itself and the manner in which it is placed in position, are shown in the above illustration, the improvement forming the subject of two recently issued patents. This tiling is made and put on so as to form tight joints and a smooth surface, the separate tiles being removable, when required, without breaking, as nailing is not necessary. They are also designed to afford the maximum of strength without exceeding the average weight per square of tiles now in use as roofing, while the face designs of the siding may be so various in pattern and colors that the architect is enabled to arrange an almost infinite variety of combinations.

In Fig. 2 is shown a sectional view of a side wall, illustrating the manner of suspending the tiles upon laths nailed to the wood studding, cleats slightly beveled on their lower edge being nailed to fit tightly above each row to secure the side tile in position. These cleats are not required to be beveled for roof tile. Figs. 5 and 6 represent plain and ornamental siding tiles, Fig. 9 indicating their finished appearance in position, while Fig. 8 is a sectional view and Fig. 7 is an ornamental coarse strip, border, or moulding. Figs. 3 and 4 are front and side views of the roofing tile, Figs. 10 and 11 being similar views of these tiles in position on a roof.

It will be seen that these tiles have flanges, whereby water is prevented from passing into the joints at the sides and upper edges, the lower edges of the tiles above hanging clear of the upper edges of the next lower tiles, portions of the upper surfaces of the roof tiles also having deep grooves leading downwardly from the upper flanges to convey water to the outer surfaces. The upper flanges of the tiles also have stops opposite the upper ends of the grooves to prevent water and snow from being blown upward. Portions of the face of the roof tiles also have diagonal side grooves conveying the water toward the larger channels centrally in the face of each tile.

These tiles may be made of such sizes that all cutting around doors and windows will be obviated. Among their advantages over the ordinary wood siding is the fact that they are fireproof, while they require no painting, and their durability and elegance are obvious.

Further information relative to these tiles may be obtained of Messrs. F. N. Marvick & Co., San Mateo, Florida.



MARVICK'S SIDE AND ROOFING TILE.

Dulcine.

Dulcine is a product which, because of its intense sweetness and its non-poisonous character, seems destined to become a serious competitor of saccharine. It was prepared first in 1883 and its sweetening power then recognized; but the cost of manufacture was too great. Patents have now been applied for its preparation from *p*-phenetidine by the action of ammonia and carbon oxychloride. The chemical name for the compound is *p-phenetol-carbamide* and its formula $C_6H_4(OC_2H_5)NHCONH_2$.—*Apotheker Ztg.*, 1892, 550; *Am. Jour. Pharm.*

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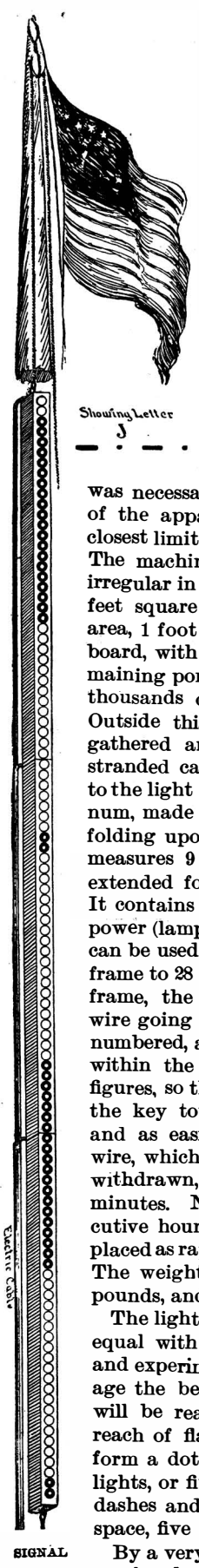
AN IMPROVED ELECTRIC LIGHT SIGNALING APPARATUS.

The present method of signaling at sea by codes, with flags, cones and lights, is often tedious, and in many cases there is a good deal of ambiguity about the signals or a want of the necessary thorough understanding between the sender and receiver.

So also in signaling upon land, by means of semaphore and heliograph, etc., there is always a wide margin for mistakes, aside from the tediousness of the work and the necessary limitations of this method of communicating information. The accompanying illustrations represent an improved method of signaling, designed to meet all the requirements of such a service, both upon sea and land, and adapted for day or night use.

BOUGHTON'S "TELEPHOTOS," FOR DAY AND NIGHT SIGNALING.



SIGNAL STAFF.

The improvement is styled the "telephotos," and is the invention of Mr. C. V. Boughton, of Buffalo, N. Y. The Morse alphabet is employed in this signaling apparatus and, by means of novel and ingenious electrical connections, the signs indicating each letter of the code are simultaneously displayed by simply pressing once upon a single key, after the manner of operating a type writer, the dots and dashes then being marked by corresponding bars and beams of electric light, with distinctive intermediate spaces, upon the side of a suitable signal staff.

That the device should be entirely practical, and adapted for the widest range of service, it was necessary that the dimensions and weight of the apparatus should be kept within the closest limits, that it might be readily portable. The machine case, therefore, is of aluminum, irregular in form, and occupying an area of 2½ feet square by a depth of 6 inches. Of this area, 1 foot 6 inches is taken up by the keyboard, with 37 letters, numerals, etc., the remaining portion being taken up by the several thousands of electrical connections required. Outside this area the connecting wires are gathered and stopped together as an unstranded cable of 1¼ inches diameter, and led to the light frame. The latter is also of aluminum, made in three parts with the two ends folding upon the center, in which position it measures 9 feet by 1 foot square, and when extended for use, 27 feet by 6 inches square. It contains 106 incandescent lights of 32 candle power (lamps of any power up to 110 candles can be used with a possible elongation of the frame to 28 or 29 feet). On reaching the light frame, the cable spreads out, each separate wire going to its proper lamp. Each lamp is numbered, and each binding post and cross bar within the machine bears the corresponding figures, so that any lamp failing to respond to the key touched, the cause is easily traced, and as easily remedied, even to a defective wire, which, if ever necessary, can be traced, withdrawn, and replaced by a new one in a few minutes. New lamps will burn for 600 consecutive hours, and when exhausted can be replaced as rapidly as those in every-day store use. The weight of the keyboard will not exceed 75 pounds, and that of the light frame 120 pounds.

The lights at night will be visible at distances equal with other electric lights of like power, and experiments now made with lenses encourage the belief that eventually the telephotos will be readable from distances beyond the reach of flags in broad daylight. Two lights form a dot, and the minimum of a dash is 20 lights, or five feet. The blank space between dashes and dots occupies the same length of space, five feet. Two red lights mark periods.

By a very simple arrangement the apparatus can be changed as desired for secret signaling, by means of a thumb screw and ratchet, whereby the letters and characters are transposed as desired. When two instruments are talking with each other, the one receiving would acknowledge the symbols as received, and in case of secret signaling the characters of each instrument would be shifted in the same way.

On shipboard the keyboard can be located where most convenient, as any length of wire can be used in connecting it with the light frame, and the latter may be occasionally, as required, hoisted to or permanently fitted at any desired point, and read vertically, or it can be laid along the hammock rail and read horizontally; the same applies to semaphore, signal stations, light houses, and light ships A simple mechanical arrangement will turn the light frame in any direction when permanently fitted to a mast.

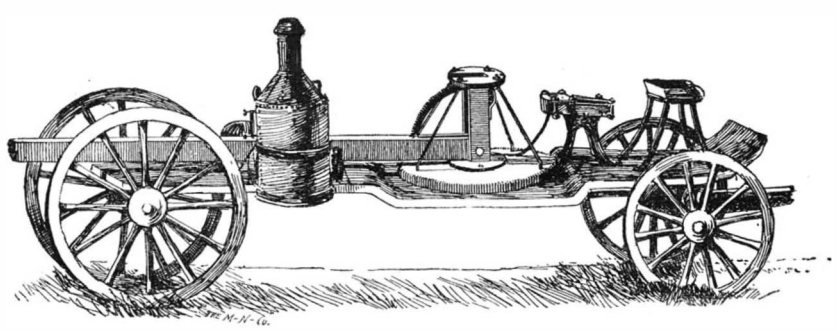
For field work, a special wagon with appliances for raising and lowering the frame is designed, and the weight and requirements for handling will stand comparison with what field telegraphy calls for. The weight of the wagon filled with apparatus will not exceed 1,500 pounds. An attachment for the automatic printing of the messages sent and received by the apparatus, by which, it is said, 72 letters have been practically sent and read per minute, has been added. It will only print the letters in Roman characters when the light has been clearly displayed. The signal is designed to be plainly visible for about three miles by day or ten miles by night.

A NOVEL CUTTING-OFF MACHINE.

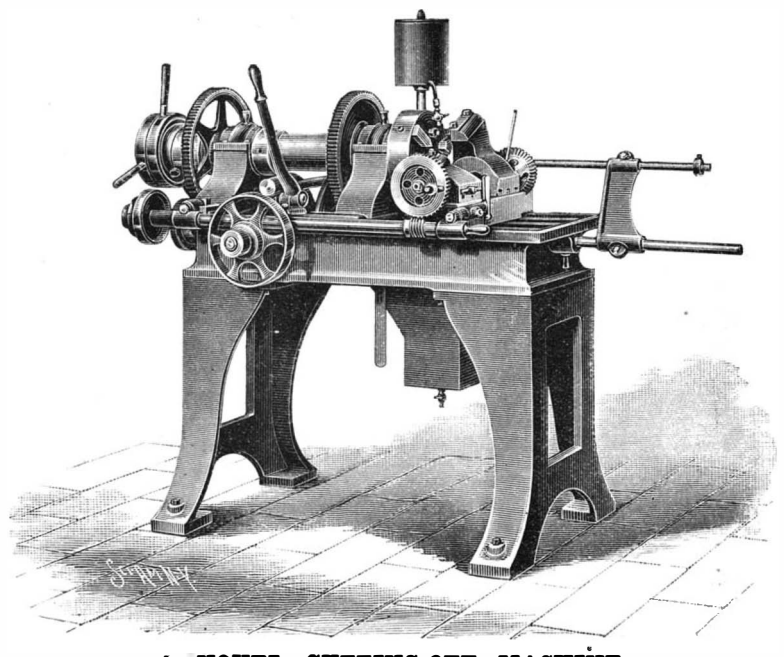
In this machine, in place of the usual cone pulley for driving and varying the speed, is a device producing a constant-cutting speed of the stock against the tools, which means, in other words, that the speed of the main spindle carrying the stock is automatically increased as the diameter on which the tools are cutting is decreased. This result is obtained by means of a friction wheel, traveling on the face of a disk; but, in this case, the usual arrangement is improved by using *two* leather-covered disks, revolving in opposite directions, and pressed upon opposite sides of the smaller friction wheel by a spring. The two friction wheels are used diametrically opposite to each other, and, contrary to the usual custom, these are the drivers and the disks the driven wheels. The friction wheels are mounted on feathered shafts sliding in sleeves driven by the pulleys shown in the cut, and are governed in their movements across the faces of the disks by a rigid connection with the cross feed screw of the tool blocks, any movement of the latter producing a corresponding motion of the wheels. At the start, with the tools working on the largest diameter of the stock, the friction wheels being the drivers must run on the largest diameter of the disks to drive them at the slowest speed, thus giving the greatest leverage at the time when most needed. As the tools feed in and the worked diameter of the stock decreases, the friction wheels are also fed in onto a smaller diameter, and therefore the disks are driven at a higher speed. Each disk is geared to the main spindle, the two together giving ample power for very heavy chips. A wedge, operated by the handle seen in the cut, spreads the disks from the wheels, allowing the tool blocks to be moved quickly in or out.

These machines have an improved form of tool block, very solid and rigid. The cutting blades are set at an angle with the line of travel, and are supported clear out under the cutting point. The whole machine is designed to be stiff, solid, and durable. The machine cuts 2 inch "cold rolled" or soft steel in 50 seconds easily, and in a cut for time only, cut several pieces in 28 seconds each, at a cutting speed of about 30 feet per minute. The machine embodies several patents. It is made by the Hurlbut-Rogers Machine Company, of South Sudbury, Mass., who will give any further information desired.

THE Phœnix Bridge Company, of Philadelphia, has signed a contract for a tower to be erected at the Columbian Exhibition. It is to be constructed of steel, and will be in shape an open framework cylinder, 560 feet in height and 210 feet in diameter. The platform at the summit will be reached by a circular inclined railway, which will be operated by electric power, the grade being about 8 feet in a hundred. The ground space of the tower will be occupied by a spacious restaurant and the summit will be crowned by an observatory, where will be located search lights and other devices for electrical display. The tower is to be constructed as a permanent structure.



TRUCK AND TURNTABLE FOR BOUGHTON'S "TELEPHOTOS."



A NOVEL CUTTING-OFF MACHINE.

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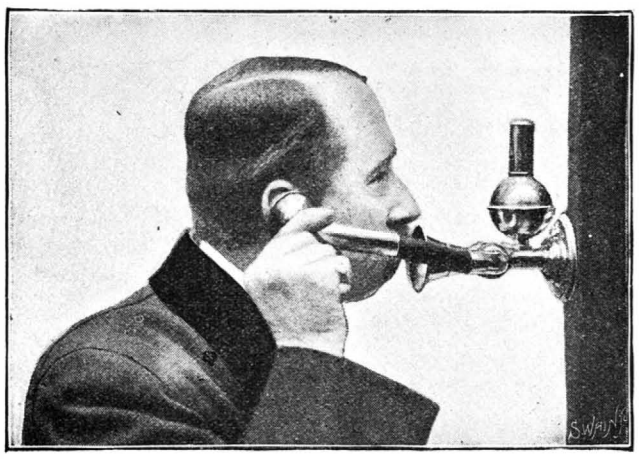
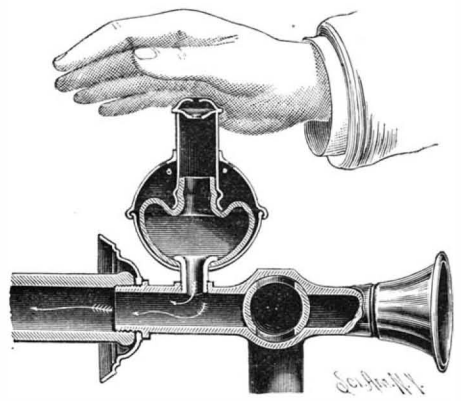
AN IMPROVED SPEAKING TUBE.

This device, patented in America, Europe, Australia and other countries by Mr. H. A. Cutmore, does away with many objectionable features of the old-fashioned speaking tubes, the whistle being automatic and there being no necessity of changing the tube from mouth to ear, and *vice versa*, during conversation. A few inches beyond the mouthpiece into which the speaker talks is a cock, in which is a plug leading to a flexible



CUTMORE'S "HOMACOUSTIC" SPEAKING TUBE.

tube, at the end of which is an ear cup, the arrangement being such that when the ear cup hangs down the passage to the mouthpiece is closed, and when raised to the ear the passage is opened, and the voice from the speaker at the distant end of the tube comes through the flexible tube to the listener. Just beyond the ear tube connection, in the top of the main tube, is a connection with a globular metallic air chamber, in which is a rubber bulb and whistle, a plunger working vertically in the top of the chamber, and by pressing with the hand upon this plunger, as shown in one



SPEAKING TUBE WHISTLE.

of the views, the usual call or whistle is sent to the distant end of the tube. By means of a switch plate, shown in another view, the operator may be placed in communication with any number of other rooms without the multiplication of flexible tubes, mouthpieces, whistles, etc. The lower plate of the switch is rigidly fixed to a given number of speaking tubes, and on it revolves an upper plate provided with whistles and indicator shutters corresponding with the different tubes, the upper plate being revolved by a small knob to connect with any of the different tubes through which a call may have been received or it may be desired to talk. The throwing back of the shutter, as shown, indicates the tube through which the call comes, and the pressing upon the plunger sends the call when the proper connection has been made. The improvement can be readily fitted to existing speaking tubes at small cost.

SPEAKING TUBE SWITCH.

This speaking tube is made with different attachments for a variety of uses—being furnished with a suitable pedestal for fixing on the floor by the side of a desk, novel tube connections for use under a desk or on a wall behind a chair, and double ear tubes for use in factories, machine shops, etc., where there may be an unusual amount of noise. A form of instrument has also been especially designed for use on board ship in connection with a system of electric signals.

Further information relative to this improvement may be obtained of Mr. S. Stretch, Jr., No. 527 West Twenty-third street, New York City, where it may be seen in practical use.

Forell's Portland Cement.

Roman cement has been defined at the international meeting of cement makers as a product obtained by heating aluminous chalky marl below the temperature of fritting until the carbonic acid is driven off and then reducing it to a fine powder. All Roman cement thus made contains a varying percentage of lime and hydraulic factors. The hydraulic factors mostly consist of hydrate of alumina, hydrate of silica, and peroxide of iron, the amount of the hydraulic factors depending upon the nature of the raw material used. When water is added to the Roman cement, these hydraulic factors combine with the lime and cause the cement to set. This setting, however, is very imperfect, as the combination of the lime with the hydraulic factors is very incomplete.

According to the invention of Carl von Forell, of Brunswick, Germany, powdered hydrate of calcium is added to the powdered Roman cement, so that the lime and the hydraulic factors contained in the mixture may, respectively, be in the proportion of seventeen to ten. The amount of the hydraulic factors in the Roman cement is first ascertained and the hydrate of calcium added, to bring the mixture up to the desired proportions. The mixture is then ready for use, and will be found to possess the essential characteristics of Portland cement, although much cheaper to make, as true Portland cement requires a very high temperature and thorough calcination for its production.

Another improved cement of Forell is made as follows:

Roman cement is analyzed and the amounts of lime and of the hydraulic factors are accurately determined. A chemical substance is then added to the cement, so that the mixture shall contain seventeen parts of lime to ten parts of the hydraulic factors. The chemical substance preferred for this purpose when the cement contains lime in excess is the silicate of alumina, which is a hydraulic factor, and this substance is mixed with the cement in the form of powder. The resulting composition of matter is a very superior artificial cement, and the exact proportions of the mixture are very important, as when water is added to the mixture there ensues a perfect and complete combination between the lime and the hydraulic factors, and neither the lime nor the hydraulic factors remain in an uncombined condition in the cement.

This cement is very strong, but sets with only moderate thickness. The use of silicate of alumina is preferred, because of the existence of lime in the form of silicate of lime in cements which are burned at a comparatively low temperature, and because lime and silica have the property of combining with each other in various proportions.

An Eight Mile Submarine Tunnel.

The shore and submarine borings between Capes Traverse and Tormentire have proved beyond a doubt the correctness of deductions published years ago by Sir William Dawson, Dr. Selwyn, and Dr. Ells, of the Dominion Geological Survey, which pointed to a continuous and watertight formation under the Northumberland Straits, along the alignment of the eight mile tunnel proposed in 1886 by Sir Douglas Fox in consultation with the Hon. W. W. Sullivan (now chief justice), as being the only feasible means of placing the Province of Prince Edward Island in "continuous daily communication" with the mainland of Canada as demanded by the "terms of confederation."

The geological formation under the Northumberland Straits is the Lower Permian, consisting of alternating layers almost horizontal, but dipping toward the island, of red clay shale and fine red sandstone, structures eminently and economically suitable for subaqueous tunneling. Consequently there is every prospect of this advanced engineering project being commenced by the government before the close of 1893.

Sir Douglas Fox, the Dominion consulting engineer, will probably grade the tunnel from the mainland through a 30 foot continuous bed of red clay shale for six miles, thence for the remaining two miles to Prince Edward Island intersecting numerous alternating beds of shale and sandstone.

Mr. Alfred Palmer, Mills building, New York City, reporting engineer of the scheme, and Mr. Herbert Hind, resident engineer of the Hudson River tunnel, hold a Canadian patent which will enable the contractors to carry out this immense undertaking within the short space of two years.

Their invention consists of sinking shafts or caissons, with or without the aid of air pressure, at predetermined points (say one mile intervals) along the axis of the proposed tunnel, and down to the level of the proposed tunnel, thence driving headings in both directions. Thus by this simple method twelve or more headings may be driven at the same time and the work carried on, with six or more times the speed over the usual method of driving two headings, one from each shore, and meeting in the center.

The proposed tunnel is to be constructed of brick set in cement (large quantities of clay free from lime being found in the island), but where the slightest dampness manifests itself, cast iron segments grouted behind with cement will be used, as in the St. Clair (Sarnia) and Hudson River tunnels.

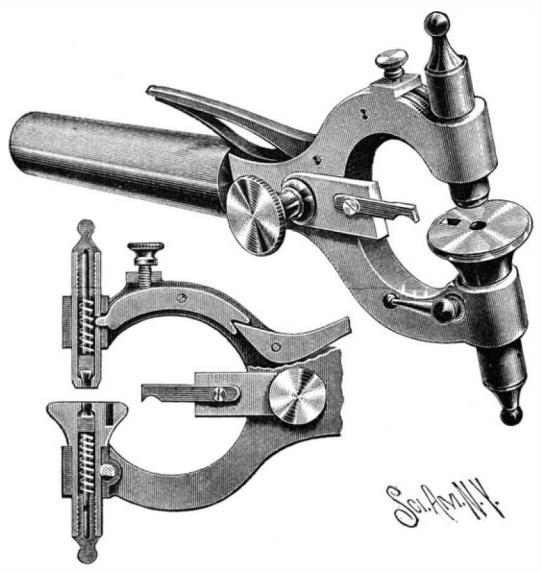
Electricity for all power and light will be used throughout the construction of the work. Traffic also will be worked by its agency.

The method suggested by Sir Douglas and Mr. Francis Fox for ventilating this lengthy tunnel is to place an exhaust fan at one end of the tunnel, and by closing a door at the other end a partial vaccum is thus formed until fresh air enters, each time the door is opened to permit of the passage of the trains.

In our issue of November 26, 1892, we illustrated the novel apparatus used for testing the geological formation, and as the attention of the scientific world is already being drawn to this advanced and interesting engineering project, we shall hope at some future time to illustrate and describe the same for the benefit of our readers.

AN IMPROVED WATCHMAKER'S TOOL.

The tool shown in side view and enlarged section in the illustration combines a calipers for truing balance wheels, a beat indicator, and a poising tool. It has been patented by Mr. George W. Cameron, of Poplar Bluff, Mo. The fork of the tool has tubular bearings, in the lower one of which is held a threaded sleeve containing a spring sliding block and a screw plug, while in the upper bearing is a sliding sleeve carrying a sliding block, spring and screw-threaded plug, the latter serving to adjust the tension of the spring without changing the position of the block. A lever mechanism applied to the handle and fork positively adjusts the sliding sleeve and its contained parts up or down. The threaded sleeve in the lower bearing carries also a jewel block, spring and screw plug, and a nut for clamping the latter in place. In line with the space between the two heads is adjustably held an indicator arm. The adjustment of the tool, by means of the nuts and sleeves, for the different uses to which it may be put, can be very readily effected.



CAMERON'S WATCHMAKER'S CALIPERS.

Ants in Africa.

A correspondent of the *Daily Graphic* writing from Umtali says:

Sir John Lubbock ought to come and live here; he could revel in ants. There are millions and tens of millions of them. The ground round our huts is riddled with deep holes, the entrance to white ants' nests. These insects are terribly destructive; a leathern bag will be eaten into holes in one night. I think everything in the country would be devoured by them if it were not for the black ants. These are quite half an inch long, and they prey on the smaller white ants. One suddenly sees a long black line extending for thirty or forty yards along the hospital compound. The line moves with a sharp, rustling sound, like the crisp rustling of dried leaves. One looks closer and finds that the black line is an army of ants going to storm a white ant heap. One ant alone goes at the head of the column, which is about eight inches wide. On each side run single ants, bustling up stragglers and rushing to drag sticks and straws out of the way of the army, which streams down into the nest it has in view, and in about ten minutes streams home again in excellent order, each black ant carrying a white one. It is a most curious sight. There are very few birds to be seen; a few golden orioles and some dear little black and gray birds, the size of tomtits, are all that one comes across.

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Correspondence.

Do Birds Eat Acorns?

To the Editor of the Scientific American:

In your issue of December 3, 1892, your correspondent from Troy, N. Y., says that woodpeckers and blue jays do not eat acorns, but do appear to, while they are only opening the acorn in order to secure the juicy morsel—the worm. I think that your correspondent is lying under a misapprehension in regard to the matter. I have seen blue jays that were domesticated eat white oak acorns, and I have shot wild pigeons whose crops were filled with them. Gray squirrels do eat acorns, to my certain knowledge, when they are in captivity. Your Troy correspondent to the contrary notwithstanding, the Iowa gray squirrel would starve to death before he would eat a worm.

N. B. PAIN.

Eagle Grove, Iowa, December 5, 1892.

Acorn-Eating Woodpeckers.

To the Editor of the Scientific American:

In your issue of Dec. 3, Mr. Nial, of Troy, N. Y., questions Dr. Gibbs' idea or assertion that the woodpecker and blue jay eat acorns. I have quite near my stable an oak (Quercus agrifolia) bearing a full crop of nuts. To this tree hundreds of jays and woodpeckers come, carrying off the acorns and stowing them away in every nook and crevice they can find. The woodpecker drilling holes in fence posts (redwood), under the eaves, and about houses, wherever he can find soft wood, much to the annoyance of the householder. I have taken nuts out of these deposit holes months after they had been placed there and found them perfect and no trace of a worm. I have also gathered acorns and kept them one and two years; when opened, dry and perfect. It is said the woodpecker places the acorn in the hole point inward (fact), so that the water running down the tree leaves the porous base of the nut and thus extracts the bitterness.

The Indians use the acorns for bread making; they are bitter when they first fall from the tree, but later on they sweeten. "Rains and melting snows extract the bitter and injurious principle and leave the farinaceous and starchy." Do not the birds lay away for the same purpose, and not for a worm?

Nordhoff, Cal. JOSEPH HOBART.

A Peculiar Gas Well.

To the Editor of the Scientific American:

I have a gas well on my farm which is very peculiar in its habits, and if any of your readers can explain it would enlighten a good many in my vicinity at least. Three years ago last summer I was drilling for water, and at the depth of 160 feet I struck a vein of sand that took all of the water I could put down. I stopped for a few days, when my man lighted a match and found that we had a small amount of gas. I put a pipe to it and it continued to get stronger until I could get a flame as large as the pipe (that is, 4 inches) and 6 or 8 feet high.

It continued to flow until cold weather, when it went away. I thought I had just struck a pocket and it was all gone; but after a while we had a rain, when here comes the gas again. Now, since then I have piped it to the house and we use it for light and fuel in the cook stove. It is burning now with a nice white light, but it will be gone in the morning, as the weather is cold, with northwest wind. Before a rain it will commence to suck and sometimes continue sucking for several days, according to length and severity of the storm. When it first comes it blows air out, and when the gas comes the flame is as blue as the sky and no light; but it finally changes to a red, and last to white. Sometimes it only stays a few hours, and again for weeks. There is a very black soot on all that the flame comes in contact with, and when not burning has a peculiar smell, and none in a room when burning. The country is fine, black loam soil, blue clay in about 10 to 15 feet from surface; it is 100 feet and more thick. About eight miles northeast is a gas well, 180 feet deep, with a pressure of 10 pounds on a steam gauge; also in that locality they strike gas in 12 to 30 feet, digging wells; but do not know if any have that peculiar affection for the weather. My well has 136 feet of 4 inch casing, and then is piped to the house in a 1½ inch pipe. I would like to hear from any inquirers who think they can solve the problem, or be glad to have answer in SCIENTIFIC AMERICAN.

JOHN A. ROBERTS.

Morton, Tazewell County, Ill.

[That you should obtain gas from beneath a thick bed of clay underlined with soft coal is not at all strange, but rather may be expected. The soft coal beds are impregnated with gas that gives great trouble to the miners in all the soft-coal-bearing States. We have had several communications in regard to the blowing wells in the Western country. The cause seems to be due to the variation in barometric or air pressure during stormy periods. A falling barometer indicates lighter atmospheric pressure, causing the well to blow or breathe, as some call it, while a rising barometer makes the well draw air in. The change in the color of the flame arises from the mixture of air with the gas in the pipe. There is but little doubt that the pressure of the atmosphere is felt well down in the depths of the earth, wherever there is soil or sand that is pervious to water or gas, and through any openings through the vast clay and rock beds of the Western States, lying as they do nearly level and covering great areas. The barometric air waves sweeping over these areas must cause a tidal action upon the air or gas spaces beneath the earth's crust, as it is well known to do upon the Western lakes by causing a surging of the waters from shore to shore.—EDITOR.]

The New Chronology of the Pantheon.

About two months ago we referred, with astonishment and no little skepticism (a feeling shared by some of the first English archæologists of the day), to the theory about the rotunda of the Pantheon which had been propounded by M. Chedanne, a young French architect, and set forth in an article in the *Revue des Deux Mondes* in August last by the French sculptor M. Guillaume, to the effect that the rotunda was not of the age of or the work of Agrippa, at the date of 27 B. C., but a building of the second century A. D., erected in the reign of Hadrian, and that it was tacked on to the portico, instead of the reverse process hitherto believed in. The inherent architectural improbability of the portico being erected first and a circular building added behind it seemed too strong an æsthetic argument to be passed over, and it must be added that the rather inflated style of M. Guillaume's article, which was manifestly a piece of trumpet blowing for French archæology, was not calculated to predispose one to an attitude of faith. Whatever we may think, however, of the good taste of the *Revue des Deux Mondes* article, it would appear that the trumpet has not been vainly blown, and M. Chedanne has led the way to one of the most important discoveries for some time back in Roman archæology, and has established the fact of the later date of the rotunda, though, as we shall show, there is room for another theory than the improbable one of the round building having been actually built against and fitted to the portico as it stood. Possibly, if M. Chedanne had written the article himself, in a more practical style, and accompanied it with representations of some of the objects which furnish the evidence for this view, he would have found more ready acceptance than was likely to be accorded to the rather exuberant eloquence of M. Guillaume.

As is known to all students of Roman archæology, an inscription on the frieze of the octastyle portico records that the Pantheon was built by Augustus' able minister and relative, Marcus Vipsanius Agrippa, during his third consulship, that is, in the year 27 B. C. The inscription runs thus:

M. AGRIPPA . L . F . COS . TERTIVM . FECIT.

And this inscription has naturally been taken to refer to the whole structure, more especially since the point of junction between the great portico and the rotunda behind it appeared to show that both were of the same date and had been built together—not that one had been added to the other.

Early in the year 1892, the appearance of certain patches of damp on the inner surface of the dome rendered necessary some repairs to the stucco lining of the coffers of the dome and a careful investigation of the point where the rain was able to soak in from the outside.

The Italian authorities very kindly allowed the work of repair and investigation, together with the erection of the necessary scaffolding, to be placed under the superintendence of M. Chedanne, who is one of the Prix de Rome students in the Villa Medici.

This enabled M. Chedanne to make a new and very careful set of measurements of the whole building, and to produce a most valuable set of drawings for his *envoi*, to be submitted to the authorities of the Ecole des Beaux-Arts in Paris.

As already noted, the result of the investigations which were thus made has been described, with a certain amount of rather tentative theorizing, by M. Eugene Guillaume, the able French sculptor who is now director of the Ecole Francaise de Rome, in the *Revue des Deux Mondes* for August, 1892, p. 562; and the subject has also been treated by the Roman archæologist, Signor F. Bongioannini, in the "Nuova Antologia," vol. xli., serie iii., fascicolo del 1° Settembre, 1892. The conclusions arrived at by these two authorities are not altogether the same, and it may, perhaps, be well to indicate briefly what appear to be the really important pieces of evidence, and what the most probable conclusions to be derived from them seem to be.

First, with regard to the comparatively late date of the rotunda, the one really valuable and, it may be said, conclusive piece of evidence is derived from the inscriptions stamped upon the bricks which are used as facing and as bond courses in the solid concrete both of the drum and of the dome.

A large number of these bricks or tiles (*tegulæ bipedales*) have been withdrawn from various parts of the structure, and all their stamps agree as to the date of the tiles being not earlier than the first half of the second century A. D.

As examples of these brick stamps we may quote the following. The inscriptions are arranged in the usual manner in two concentric circles around a central badge or symbol. It is to be regretted that neither M. Guillaume nor Signor Bongioannini have in their articles quoted these inscriptions, which are by far the most conclusive evidences of date:

1. DOL ANTEROTIS SEVERI
CAESARIS N

Badge or *trade mark*, a bull's head. This may be translated: "Clay work of Anteros Severus [slave or freedman] of his Majesty."

2. C AQVILI APRILIS EX PRAEDI
CAES BIPEDALE DOLIA

Badge, a pine cone. "Two-feet tile of clay work made by Caius Aquilius Aprilis on the imperial clay fields."

3. ROSCIANI DOMIT AGATHOB

Badge, a bust of Isis between a palm branch and a sistrum. The translation of this is doubtful; it may mean "Clay work of Roscianus [freedman] of Domitianus Agathobulus."

4. APRILIS CN DOMITI
AGATHOBVLI

Badge, a bull's head between two palm branches. "Clay work of Aprilis [freedman] of Cn. Domitianus Agathobulus."

5. TEG DOL DE FIG IVLIAE
PROCVL FLV NEG

"Tile work of clay from the potteries of Julia, the daughter of Proculus."

All these inscriptions have previously been discovered on bricks in other buildings, and they are known, from various reasons, to be of about the time of Hadrian. Brick stamps of any kind of as early a date as Agrippa's time, in Rome at least, are unknown.

The fact that *tegulæ* bearing these inscriptions have been found in many different parts both of the walls and of the dome is sufficient evidence that they do not belong to a partial repair of an older structure. They must, therefore, be taken as evidence that the existing rotunda and dome were not built till about a century and a half after the time of Agrippa.

The second important piece of evidence was the discovery of an earlier pavement nearly seven feet below the present floor of the rotunda, showing that the original Pantheon stood at a considerably lower level than the existing building.

On the whole, the most probable theory of the structural history of the Pantheon appears to be this—that Agrippa built the existing portico, which bears his name, as the approach to a *cella*, which was probably of the normal rectangular form; the pavement of this *cella* being that of which a portion has been exposed at the lower level.

Then, in the time of Hadrian, the original *cella* was pulled down, and in its place the present domed rotunda was built, with its floor at the higher level.

Agrippa's portico was at the same time taken down and carefully rebuilt on to the new circular *cella* at the higher level; the inscription on the frieze not being interfered with.

This would account for the absence of any signs of two different dates at the junction of the portico with the rotunda. The inscription, therefore, must be taken to refer to the portico only, with its sixteen magnificent monolithic columns of red and gray Egyptian granite.

At present this theory is only conjectural, but there can now be little doubt as to the rotunda not being earlier than the second century A. D. Further investigation may possibly throw clearer light on this difficult and very interesting problem.—*The Builder.*

Moisture in Gases.

The important bearing of moisture upon the combination of gases, and in some cases even when this combination is attended with combustion, is mentioned by Sir Henry Roscoe in the course of an appreciative notice in *Nature* of a book of chemical lecture experiments recently published by Mr. G. S. Newth. Mr. Newth gives several experimental demonstrations of the fact that many gases, when perfectly dry, do not combine; carbonic oxide and oxygen being of the number. Sir H. Roscoe adds a striking illustration to those mentioned in the book. It is as follows: Dry a current of carbonic oxide over glass balls moistened with strong sulphuric acid; light the stream of gas as it issues from a horizontal tube; then plunge over the blue flame a cylinder full of air which has been previously dried by shaking it up with a little strong sulphuric acid. The flame instantly goes out. This remarkable result of extinguishing a flame of gas by merely dried air is very suggestive of the hidden value that may attach to what are commonly regarded as impurities in chemical compounds and mixtures.

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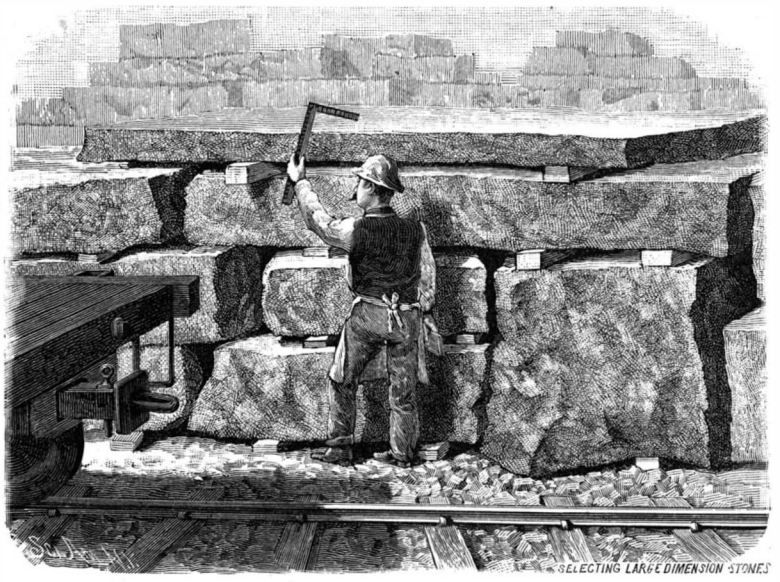
THE POTSDAM RED SANDSTONE QUARRIES.

A perfect building stone is far from being a common product of nature. To be qualified as a perfect building material, a stone must unite the qualities of resistance to weather and to fire, must be of good appearance and impervious to moisture. It should also not be of such a tint as to become dingy or of ugly color when exposed. The streets of this and other cities furnish the best possible example of defective building stones. Brownstone buildings are seen whose carved portions are disintegrating and the faces of whose smooth wall pieces are flaking off. To avoid this destruction various suggestions and experiments have been made either in the way of chemical treatment or of method of laying, but nothing seems to stop it. The experience of Boston and of other cities has demonstrated how poor a resistant to fire is granite. Granite is often a stone of handsome appearance, and will in some cases stand any amount of exposure to the elements, but it is very unsatisfactory in the presence of a conflagration. Although stone is everywhere recognized as the noblest and most desirable of building materials, yet so great has the difficulty of securing good stone become that many large buildings are built entirely of brick and terra cotta, the art of man being relied on to surpass nature.

The Potsdam sandstone is a member of the lower Silurian group and rests upon the primitive rocks of the Eozoic. This lower portion of the Potsdam formation varies from an absolute quartzite to a sand. In the present issue we illustrate the quarries at Potsdam, N. Y., from which this stone is extracted for building purposes. Here the famous sandstone is attacked at the place where it seems to be of the best average quality. A thickness of 70 feet is exposed in the quarries. At this point it is almost a quartzite.

The examination of a microscopic section of the rock discloses the following characters: It is found to consist of angular grains of clear quartz, quite unmixed with other granular material. There is no feldspar or mica intermingled with it. The interstices between the grains contain a cementing material. This is found to be a clear, colorless silicious cement, so that the rock is virtually silica. On this point, Professor Thomas Egleston, of the Columbia College School of Mines, and an authority on building stones in the United States, in a paper read before the American Society of Civil Engineers, on the decay of building stones, says: "Of the sandstones having a silicious binding material, Potsdam sandstone, which has been used in the recently constructed Columbia College [an engraving of which is published herewith], and the silicious triassic sandstone, which was the material used in the lower part of the cathedral at Rodez, are the best examples, and in these no decomposition takes place. Of these sandstones, it will be noticed that there are two general varieties, one in which the quartz grains are more or less large, and are rounded, but are cemented together by silica. . . . In the Potsdam sandstone, on the contrary, the grain of the quartz is quite small; its shape, when it can be distinguished at all by a magnifying glass, is always angular. . . . This is the best of all building materials, though mouldings made of the other variety (large grains) will last for many years without suffering any appreciable amount of deterioration."

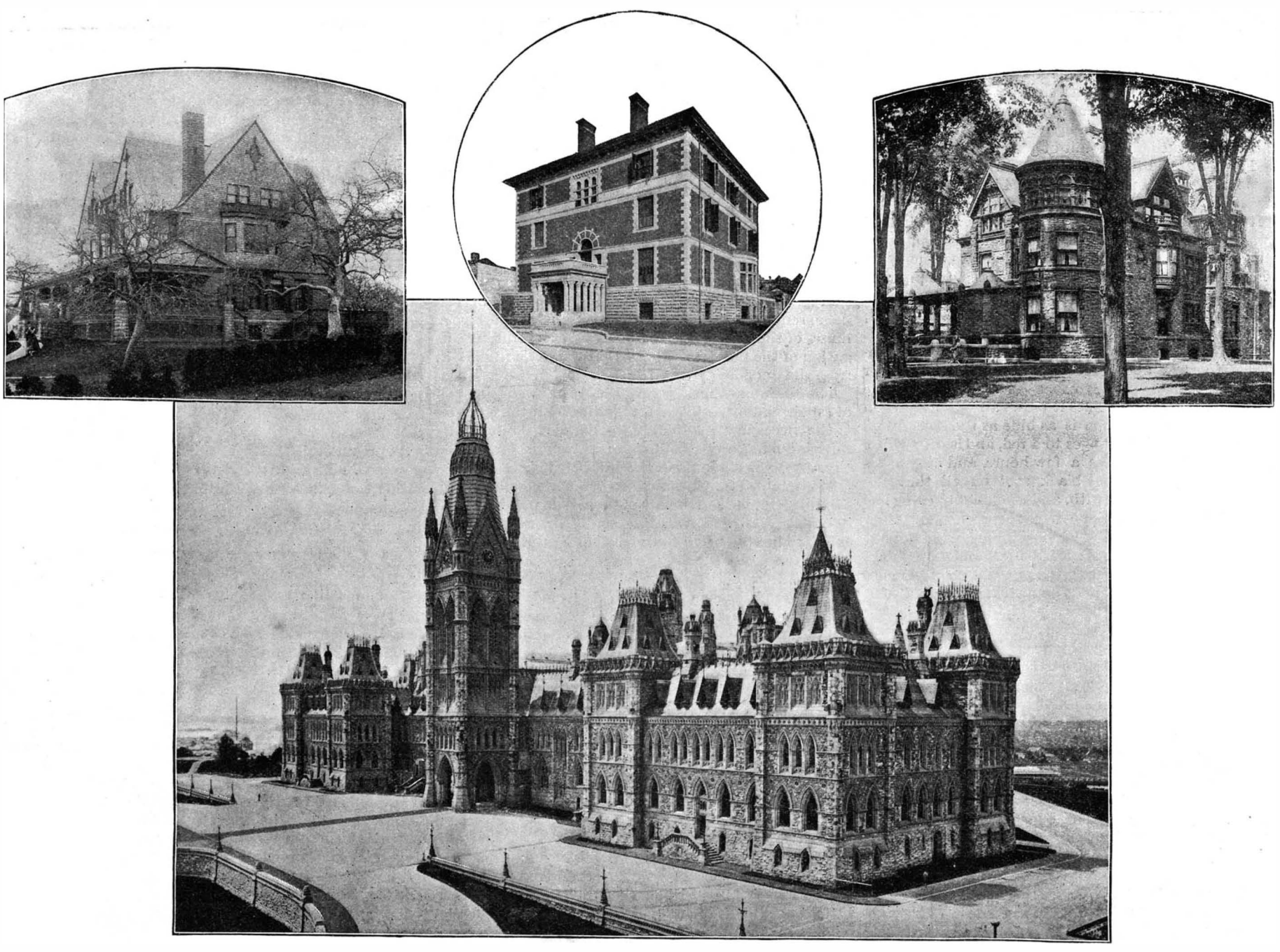


SELECTING LARGE BLOCKS OF STONE.

The other sandstones vary greatly from this. In many cases the quartz grains which form a body of sandstone are mixed with grains of feldspar and mica, which in themselves present at least a chance or probability of decay. The cementing material also varies; it may be of argillaceous nature or may be even a calcium carbonate. As cements all these are defective. They always tend to yield to the weather.

As a weather resistant pure crystalline quartz would be the best of all materials. This, of course, being out of the question, the next best thing would be in the line of a flint rock or quartzite. To the latter type, the Potsdam sandstone is closely assimilated. It departs far enough from it to be workable. Although extremely hard, it can be wrought into all the shapes demanded by modern building, including the most exquisite carvings and mouldings. Its strength is very great. It has been tested on the Emery testing machine at Columbia College in this city, and proved to be of extraordinary compressive strength. Some pieces placed in the machine and subjected to stress broke at a little over 18,000 pounds to the square inch. This figure brings it as regards strength quite out of the range of most sandstones and limestones and makes it surpass the majority of granites. But one marble and one sandstone in a very long list approaches this strength. What is still more extraordinary is that two inch cubes from one of the quarries proved too strong to be broken by the testing machine, although the pressure was carried to 151,000 pounds. This test reduces to a compressive strength of nearly 43,000 pounds to the square inch, or more than double the strength of the best granite. This result, so extraordinary as to be properly termed an anomalous one, proves what the stone may be.

We have said that granite may be weather resisting. While this is very true, it may be equally true that other samples will fail to withstand the American climate. To determine, as well as possible, what the action of the weather, including a contaminated city atmosphere, might be on Potsdam sandstone, it has been tested by subjection to acid and sulphurous acid gas. Dilute sulphuric acid, after long action, dissolved only $\frac{2}{100}$ of one per cent, or a mere trace, while some stones lost over six per cent. Sulphurous acid gas only changed its weight $\frac{6}{1000}$ of one per cent. These two tests are designed to represent the action upon it of the city atmospheres. As a direct test, samples have



PARLIAMENT BUILDINGS, OTTAWA, AND PRIVATE RESIDENCES BUILT OF POTSDAM RED SANDSTONE.

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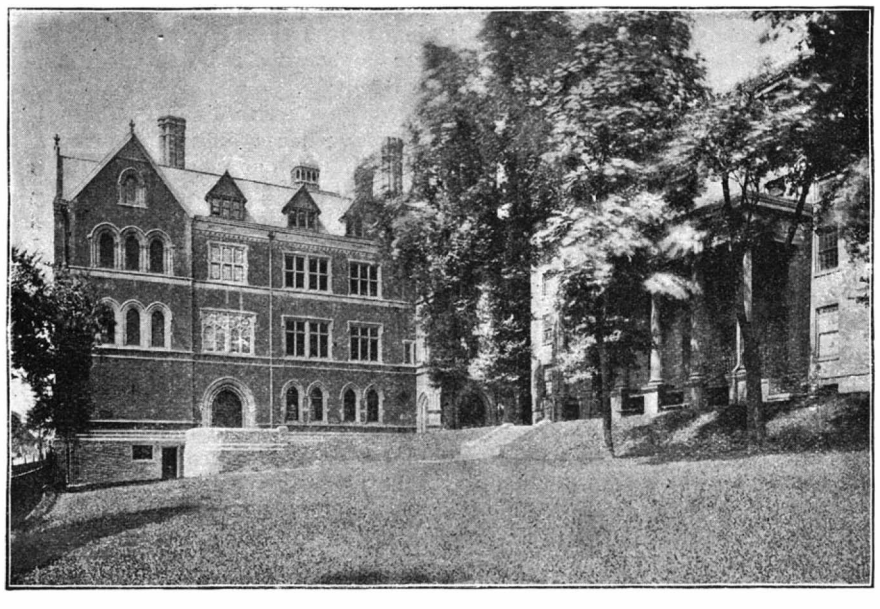
been repeatedly subjected to the severest freezing and thawing, and have remained absolutely unaffected.

In the vicinity of the quarries, buildings have been constructed of this stone, which have stood for over seventy years. Yet exposed for this length of time to the trying climate of Northern New York, the stone has preserved its fresh appearance and has not yielded in the least, the tool marks being as clearly discernible as if made yesterday. Prof. Newberry has expressed the opinion that "had the obelisk now standing in our Central Park been composed of such a dense, homogeneous sandstone as Potsdam sandstone, it would to-day be as perfect as when erected at Tanis 1500 B. C." Here it may be noted that this very obelisk, which suffered so much on exposure to our climate, is made of granite.

We have spoken of the poor qualities of granite as a resistant of fire. The action of a conflagration upon granite is to cause it to flake off; walls composed entirely of this material may thus become so reduced in thickness as to fall. It is there that the qualities of Potsdam sandstone appear at their best. It is so absolutely fire-resisting, its granular structure so completely prevents it from cracking, that it can be heated to a red or white heat without injury. By many foundrymen it is preferred to fire brick for lining cupolas, and in the vicinity of the quarries is always used for lining lime kilns. The report of Prof. Wilbur, of Rutgers College, to Dr. Smock, the New York State Economic Geologist, showed that this stone withstood repeated heating to the temperature of melted copper, and sudden cooling, without injury or change of color—something which no other stone of the large number tested by him could do.

The qualities of Potsdam sandstone have been carefully examined and tested by men of the highest scientific standing. Dr. J. S. Newberry had occasion to examine the stone in 1890, and his report fully carries out all that we have said above. Dr. Newberry is professor of geology in Columbia College School of Mines; the opinion of his eminent colleague Prof. Egleston, who has charge of the department of mineralogy in the same great institution, is sufficiently indicated by the extract from his famous essay on the Decay of Building Stone, read before the Society of Engineers, which we give above. Prof. John C. Smock, New York State Economic Geologist, and Prof. Francis A. Wilbur, of Rutgers College Scientific School, are among the authorities we may refer to. Dr. Geo. P. Merrill, of the Smithsonian Institution, at Washington, is our authority on what we have said of the microscopic examination of the stone. In his new work on the Building Stones of the United States, Dr. Merrill says, referring to Potsdam sandstone: "I consider this, from the standpoint of durability, almost an ideal stone. It is practically non-absorptive, and its surface affords no foothold for growing organism."



COLUMBIA COLLEGE, NEW YORK.

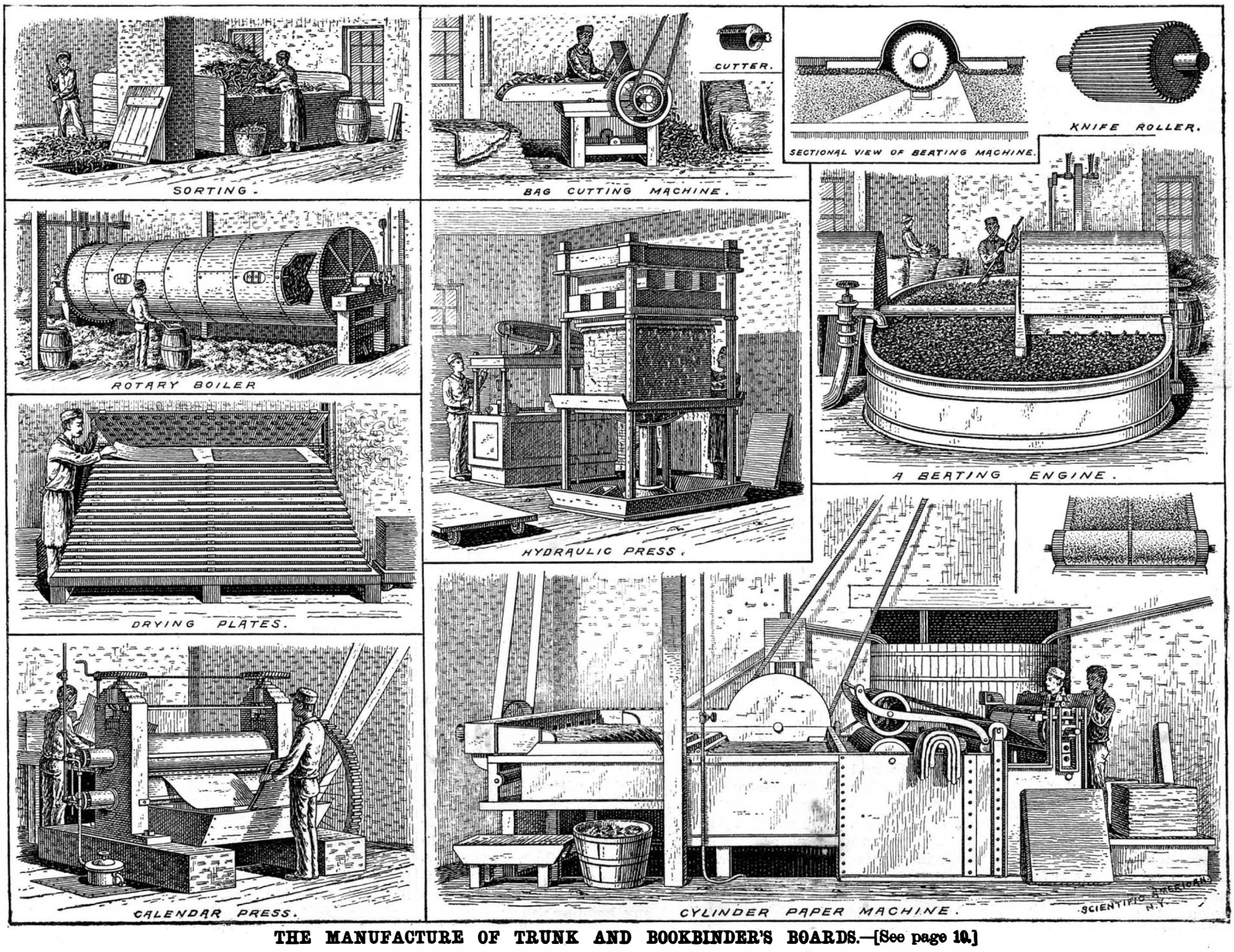
Our illustrations of the quarries and workshops of the Potsdam Red Sandstone Company, of Potsdam, N. Y., tell their own story. They show the immense scale on which the operations are there carried on. From the everyday point of view a valuable feature is the large accumulation of ready quarried stone, nearly 100,000 cubic feet usually being carried in stock, including 40,000 or 50,000 feet of the famous Potsdam random rock-faced wall facings, cut ready to ship, so that contracts can be filled immediately on receipt of orders. This puts the business on a par with the brick and terra-cotta makers, who from necessity are compelled to ship from stock, and absolutely avoids the proverbial delay in stone contracts, which is a standing joke among builders. Although it is the policy of the company to sell rough stone only, yet where local cut stone contractors refuse to make fair figures on work, their unrivaled facilities enable them to cut stone ready to lay in the building, and to set it if required in any part of the United States or Canada.

The peculiar stratification of the material as it lies in the quarries will be noticed. The natural beds are nearly perfect, which greatly reduces the cost of cutting. Immense blocks are got out almost of perfect shape, by the use of wedges and feathers, sometimes assisted by some of the patented methods of blasting. The equipment of machinery is of the most modern and complete description.

Dr. Newberry says: "The element of beauty is no less important in a building stone than strength and durability. In these three qualities this stone is certainly unrivaled."

The different quarries of the company afford a certain choice of color. The red stone is of an exceptionally pleasing and bright tint. About fifty feet of these layers is exposed in the quarries. Stone can be taken out from two to six feet or more in thickness, and can be wedged into any size from these thick stones, resembling granite in this. The company's quarries are distributed for about a mile up and down the Racquette River, and embrace the best outcrops of stone to be found in the district. Dr. Newberry reported, after personal examination, that these quarries were practically inexhaustible. We may, therefore, pronounce the company's quarries an almost ideal source of building material.

One of the cuts, showing a workman selecting dimen-



THE MANUFACTURE OF TRUNK AND BOOKBINDER'S BOARDS.—[See page 10.]

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sion stone from stock, gives an idea of the form in which stone comes from the quarry. Another cut, showing the interior of a stone cutting shed, shows workmen getting out stoop rails and other forms.

Quarry No. 1, from which the main supply is derived, is shown in two cuts. The peculiar stratification of the stone is very noticeable. It is exceedingly regular, with sudden variations in the dip. The drainage of this quarry is effected by an undershot water wheel, shown in the bird's eye view to the left of the picture. From Quarry No. 2, now under development, a medium red stone is taken. This quarry, for a long time to come, will be self-draining, as will also be the case with Quarries Nos. 3 and 4. From Quarry No. 3 a dark red stone is taken.

The Racquette River, on account of falls and rapids, is not navigable, although it is the second largest river in New York, but great numbers of logs are floated down it every year from the Adirondack forests. A fall on their quarry property gives the company nearly twenty thousand horse power, the entire river falling about sixty feet, and this will be of great value in the future development of the business, giving by means of compressed air or electricity ample power for the working of machinery now using steam, and for other purposes.

There is one product of the quarries which should be mentioned, the banded stone. Some layers are strongly banded in different colors. With these the most beautiful architectural effects can be produced. The combination of light, medium and dark red stone in solid colors and the banded variety gives great latitude to the architect in producing color effects. The colors harmonize excellently with granite or brick, and instances of this use are numerous. Among the buildings where the stone has up to this time been used for the whole or a part may be mentioned the Dominion Parliament buildings at Ottawa, shown in the accompanying engravings; All Saints' Cathedral, Albany; Columbia College, New York City; the New York State Asylums at Ogdensburg and Matteawan (costing over a million each) and numerous buildings in New York City, Brooklyn, Buffalo, Syracuse, Rome, Albany, Troy, Lynn, Washington, D. C., Rondout, N. Y., New Rochelle, N. Y., Ogdensburg, N. Y., etc., and many smaller cities and villages in the United States and Canada.

The quarries are situated near the line of the Rome, Watertown and Ogdensburg Railroad, and ship their product by the New York Central system in all directions.

MANUFACTURE OF TRUNK AND BOOKBINDERS' BOARDS.

The illustrations on the preceding page were taken from the plant of W. O. Davey & Son, Jersey City Heights, N. J. These boards are also used in the manufacture of gaskets and buttons, and are made of scraps of paper and cardboard from box and paper manufacturers with a mixture of oakum dust, shade strips, grass rope and bagging rags. The refuse cardboard is carted to the factory in large sacks, sorted over and placed in a large soaking tub. When moist it is ready for the beating engines. These engines are oval shaped and made of iron and are lined with sheet brass. They are about 13 feet in length, 7 feet in width and 2½ feet in height. The oakum dust, shade strips, rags, etc., before they go into the beating engines, have to be cleaned. They are put separately with a quantity of lime into a rotary boiler, about 20 feet in length and 6 feet in diameter, its interior fitted up with iron pins placed about 3 feet apart. The pins are about 1 foot in length and catch and separate the material as the boiler revolves. The boiler is filled with steam of about 7 pounds pressure, and revolves slowly for 12 to 15 hours, making but one revolution in every 2¼ minutes. From 1 to 3 barrels of this mixture with about 500 pounds of scrap cardboard are placed in the beating engines with about 1,500 gallons of water. This mass keeps continually moving around the tub. Attached to the shafting across the center of one side of the engine is a roller 32 inches in diameter, containing 56 knives, 3 feet in length, the blades being 2 inches in width and about 2 inches apart.

Running up to the roller is an inclined plane, the top of which conforms to the shape of the roller and runs up at the back about 1 foot. Directly underneath and within an inch of the bottom blades of the roller are about a dozen other knives fitted into an iron slot the same length as the roller blades. As the roller revolves, the wet mass is drawn under and through the narrow space between the knives and is forced up at the back and falls over. This is continued for three hours, until the materials become thoroughly cut up and mixed. If the pulp is not dark enough, a few pounds of copperas are added. The pulp then passes out through the bottom of the engine to a large tank below, where it is forced into a cylinder paper machine. The pulp is thoroughly mixed with water, which passes through and up against a fine sieve roller. This roller is 29 inches in diameter and 70 inches in length, and is covered with a double layer of fine wire netting, the meshes of which are 18 and 40. The water passes through this sieve roller, leaving the pulp sticking to the meshes. The felt belting on the roller above takes up the pulp from the sieve roller as it passes over the top. This is carried on the felt belt to the roller where the boards are formed. These rollers are hollow and made of iron, and run from 18 to 21 inches in diameter.

The pulp sticks to the upper roller as it passes between the two, the belt passing around the lower one and back to the sieve to take up the pulp again. The sound of a bell notifies the attendants of the machine when the pulp or board is of the right thickness. A sharp hook-shaped knife is then passed through two slots in the roller, and through the board as it passes around, the boards being then taken off.

After a certain number of boards have accumulated, they are taken to a hydraulic press, where a pressure of 50 tons is placed on them, which forces out most of the water. They are then taken to the drying plates, which are book-shaped, and made of copper ¾ of an inch in thickness, and hollow. They are filled with steam, which enters at the ends of the plates by means of small pipe connections with rubber joints, which connect with the exhaust pipe. The plates or leaves are 8 feet in length and 3 feet in width. After the boards have been sufficiently dried they are taken to a calender press, where they pass between two 18 inch heated rollers, which straightens and puts a gloss on them. The edges are then trimmed up and the boards are ready for the market. The boards are made of different sizes, ranging from 19 × 30 to 34 × 44 inches, and are sold at 5 and 6 cents per pound. They are about ¼ inch in thickness.

Wind the Great Force in Nature for Carrying Off Heat.

Discussing the means whereby heat is lost in buildings heated by a steam or hot water plant, *Hot Water Heating* says:

"Few people have given much thought to the many difficulties that must be met and overcome in the planning of a heating apparatus; and with a view of showing the importance of the subject, we will try to explain a few of the natural laws by which heat is lost from a building, and also the laws that may be utilized to replace it.

"Wind is the greatest force in nature for carrying off heat, and is the most difficult of all elements to contend with in heating buildings. It is, therefore, necessary that its cooling power should be thoroughly understood, that it may be provided against in the construction of a heating apparatus. The importance of this will be recognized when we explain that experiments with wind currents in glass houses have shown that a room heated to 70° in zero weather, with a still atmosphere, will be cooled 20° in 5 minutes and 45 seconds.

"The same room will be cooled 20° in 2 minutes and 35 seconds when the wind is blowing at the rate of 3 miles per hour, and it will be cooled 20° in 48 seconds when the wind is blowing at the rate of 27 miles per hour. When the fact is considered that it is a common occurrence for the wind to blow from 20 to 30 miles per hour, it will be seen how important it is to carefully consider the number and size of the windows and the exposed walls before designing an apparatus for warming a building.

"Very little has been said on the above important subject—important because the materials used in the construction of a building determine how much heat it will lose, as the heat can only be lost through the materials of which the building is constructed. All building materials have a known conducting power for heat, and, though we cannot here go into elaborate tables of comparison, we will give a few facts of interest.

"A granite wall, 18 inches thick, will lose 67 per cent more heat than a brick wall of the same thickness. A frame building, plastered on the inside and covered with paper felt and sheathing on the outside, will lose 75 per cent less heat than a brick wall of the same thickness. A frame house built without a paper felt covering on the outside will lose 25 per cent more heat than the same house if covered with felt.

"One square foot of glass will lose as much heat as 6 square feet of 12 inch brick wall. If closely fitted double sashes are used, 75 per cent less heat will be lost than with the single sash.

"The manner in which the joints of a building are fitted affects very materially the amount of heat lost; for example, a loosely fitted house may take twice the quantity of heat that would be required for one well built.

"Each square foot of outside wall of a building, each square foot of glass or window surface, and each entrance door, have a given conducting power for taking heat from the inside of a building and dispensing it to the outer air. After measuring these various surfaces and determining the loss of heat by the conducting power of the material of which it is built, we ascertain how much heat any building will lose in zero weather; by adding to this 15 per cent (which is a necessary loss up the chimney to make a draught) we have the total amount of heat lost by the building, and can easily determine the amount of coal that ought to be burned to warm it."

Street Car Mail Distribution in St. Louis.

The recent annual report of the Postmaster-General contains the following letter from J. B. Harlow, postmaster of St. Louis, regarding the electric mail car service in that city:

"In presenting the following concerning the St. Louis and suburban street railway postal car service, I desire to describe not only the car as it is, its present limited schedule, but to enlarge somewhat on the future of the system which will almost entirely change the present method of collections reaching the main office from street letter boxes, as well as the dispatch of city mail on the line of the road to letter carriers for delivery.

"The car is a miniature railway postal car, twenty feet long, and the regulation width of a street car, run under the electric system with its own motor on front and rear platform, with motorneer and conductor, sliding doors at each end, and wide sliding doors with four windows on each side of car, with slot for mailing letters on each side, with appropriate signs. The interior is well lighted with electric lights, the furniture consisting of stove, letter case amply large enough for all distribution, a rack for sixteen sacks, a stamping table, and all the conveniences of a modern railway postal car. Its run is from Sixth and Locust Streets westward to the city limits, about six miles, the schedule time being forty minutes.

"The following sub-stations are on the line of road: Sub-station 9, Fourteenth and Franklin Avenue, with three carriers; sub-station 11, 3901 Morgan Street, with four carriers; sub-station 12, the Arcade, Cabanne, 5500 West, with five carriers.

"All mail for these carriers is made up at the main office ready for delivery and is dispatched at 6:25 A.M., 9:50 A. M., and 1:45 P. M. This leaves the clerk in charge of car free to handle and distribute mail received *en route*.

"By these men reporting at the several sub-stations in lieu of the main office, or station C, there is shown by a fair estimate an aggregate saving of time to the twelve men of ten hours daily.

"It is proposed to place three more sub-stations on the line of this road, for which application has been made, and at proper intervals a number of accumulation street letter boxes where carriers will deposit their collections, these boxes to be collected by the clerk in charge as the car passes, going both east and west; mail to be distributed *en route* and dropped off at the proper sub-station for delivery. All mail not intended for line to be dropped off as car passes main office.

"From the limited opportunity to observe the possibilities of the street railway postal service it is plainly evident that the results will be to expedite the delivery and collection of mail, and thereby result in great good to the service."

We hope Congress will lose no time in passing such laws as may be necessary to extend this admirable system in New York, Chicago, and all our towns and cities. It will greatly increase the revenues and the facilities of the Post Office department.

To Keep Iron and Steel from Rusting.

The number of articles in photographic use constructed from iron and steel, from rolling presses and head rests downward, will render serviceable a couple of recipes, adapted for the purpose in other directions, which we append. One of the simplest, and which has been in use for many years, consists in coating the article with a solution of India rubber in benzol, made of about the consistency of cream. It may be applied with a brush, is easily rubbed off when needed, and effectually prevents rust. A coating of more use where the "tooth" imparted by rubber would be disadvantageous is prepared in the following way: Dissolve two parts of crystals of chloride of iron, two of antimony chloride, and one of tannin in four of water. Apply with a sponge or rag and allow to dry. A second or third coating, or more, is given in the same way that a dark color is produced. When dry, it is washed with water, again allowed to dry, and polished with linseed oil. The antimony solution should be as nearly neutral as possible.—*Br. Jour.*

The 40-inch Telescope of the Yerkes Observatory.

The large disks of optical glass made by Mantois for the University of Southern California have been purchased by the University of Chicago. They are nearly 42 inches in diameter, and will allow of a clear aperture of 40 inches. The glass is said by Mr. Alvan Clark to be exceptionally good. Mr. Clark will shortly undertake the work of grinding the objective, which he has contracted to complete within eighteen months. The contract for the mounting will be let within a short time. The site of the observatory is still undecided, but it will probably be several miles outside the city.

The contract for mounting the great telescope has been awarded to Warner & Swasey, of Cleveland, Ohio.

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SKATING ON ARTIFICIAL ICE.

It will soon be three years since, under the name of the "Ice Palace," we described an installation designed to permit of skating upon genuine ice in all seasons. The company that undertook to carry out this idea rented the spacious hall of the Plaza de Toros, on Pergolese Street, and we had an opportunity of seeing there, for an instant, the immense arena of 2,000 meters transformed into a sheet of water. But when it was necessary to freeze the latter, and the machines began to work, it was found somewhat late that there were many defects in the installation, and that it was possible to make ice only upon the edges, and even then not in a continuous manner. The directors then, taking a firm resolution, had cartloads of cracked ice brought and packed it in the arena. A few skaters had an opportunity of trying their skill upon it, but in the space of one night all was melted and the enterprise, so to speak, fell into the water. It was a folly, too, to wish to do in a few weeks what required several months of study and labor. But the idea was a good one, and was again taken up. Now skating is (and has been since the first of October) going on day and night at the "North Pole," on Clichy Street. This time the installation has been well conducted. Time has been taken, and everything has been studied and put in place with care. The principle is the same as that employed previously, and our first engraving (Fig. 1) represents the machinery room, very well arranged by Engineer Stoppani. It comprises, to the left, two steam engines of 50 horse power each, of the Corliss type, with Stoppani distributer, which run two double-acting Fixary ice machines. These machines are pumps designed to convert ammoniacal gas into liquid ammonia. To this effect, they in the first place force the gas into the large condensers represented to the right. Here it is cooled by a circulation of water derived from the city mains, and becomes liquefied in the small cylinders seen in the foreground. Thence the ammonia is led into the large reservoirs or refrigeratories that are observed upon a platform in the rear, and expands therein with the production of cold. Having returned to the gaseous state, it is taken up again by the machines, which force it anew into the condensers, and so on indefinitely. It is always the same supply of ammonia that is used. The lowering of the temperature produced by the expansion is utilized for cooling an uncongealable liquid (solution of calcium chloride) which circulates in spirals in the center of the refrigeratories. This liquid, by means of a pump, is forced into the pipes placed upon the floor of the rink.

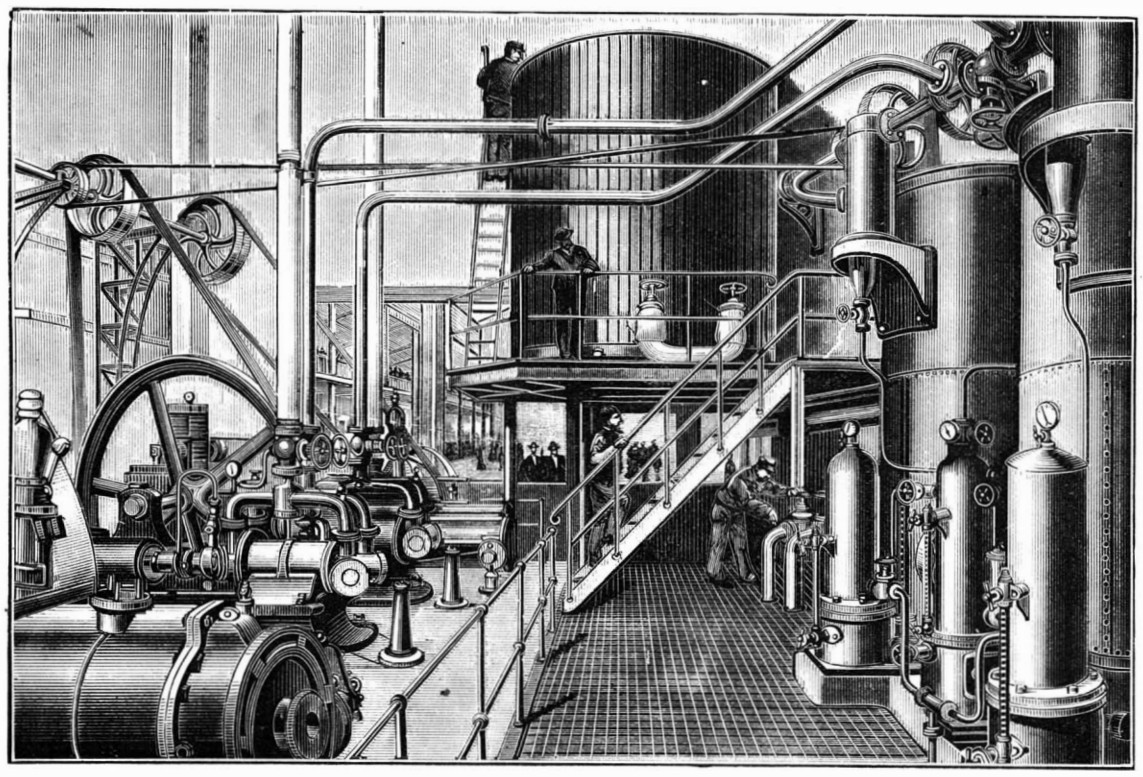

Fig. 1.—MACHINERY HALL OF THE SKATING RINK OF ARTIFICIAL ICE AT PARIS.

There is here a notable difference as compared with the installation previously tried, wherein the ammonia was expanded directly in the pipe, of the rink—an arrangement evidently defective, because of the leakages inevitable in a system of piping several kilometers in length.

The rink (Fig. 2) is 40 meters in length by 18 in width. It consists of a cement and cork floor resting upon a perfectly tight metallic foundation, and upon which is arranged a series of connected iron pipes having a total length of 5,000 meters. Each section derives its supply from two principal conduits, A and B (Fig. 3), into which constantly flows the solution of chloride of calcium cooled to a temperature that varies according to the velocity of the circulation, which can be regulated at will. When the external temperature is not very high and it is merely a question of keeping the ice in condition, a few degrees below zero will suffice, while, on the contrary, when the upper stratum, or even the entire rink, is renewed, it is necessary to descend to 15 or 20 degrees. The surface is renewed every night. After the snow produced by the incisions of the skates has been removed, there is spread over the remaining ice, by means of a pump, a sheet of water that circulates during the entire period of its congelation, in order to give a perfectly even surface. In order to prevent the spirals from producing changes of level through the contractions due to the differences in temperature to which they are submitted, they are composed of pipes that enter each other with friction to a certain length. They thus form slides that allow of a certain play. Moreover, in order that their temperature shall be as uniform as possible, care is taken to frequently change the direction of the current. In this way there is secured a uniform mean temperature in the entire circulation.

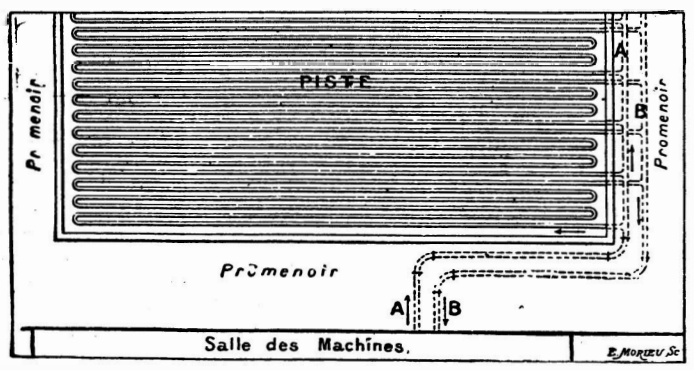

Fig. 3.—PLAN OF CONGELATION PIPING.

A, Pipe through which the freezing liquid enters. B, Pipe through which it makes its exit.

It will be seen that in this installation everything has been studied out and provided for to the least details. So, during the month or more that it has been in operation, nothing wrong has occurred, and the numerous lovers of skating have always been able to pursue their favorite exercise as well as if they were on the lakes of the Bois de Boulogne in midwinter.

A portion of the power of the motors is employed for lighting the hall, which is decorated with winter scenery. But no attempt has been made to push realism farther, and a heating apparatus keeps up a temperature of from 15 to 18 degrees.—*La Nature.*

Fig. 2.—SKATING RINK OF ARTIFICIAL ICE AT PARIS

Horse Power of Boilers.

When the horse power of a boiler is referred to, a very vague idea of the real meaning of the term is given. Most people get the impression that when we say a boiler has a certain horse power it means that the engine which it is constructed to supply steam to will exert that power when all the prescribed conditions exist. What the horse power of a boiler really means is a question that is difficult to answer. It is neither logical nor appropriate to express the steam-generating power of a boiler in units of horse power, but it seems to have become a habit which has grown upon mechanics that is hard to break off and discontinue.

The unit of horse power for boilers is not, says a contemporary, fixed except by arbitrary agreement among the parties concerned, the basis differing according to the nature of the work done by the steam. Many boilermakers rate the horse power of the boilers by the number of square feet of heating surface contained in the boiler. Although this rule is followed by many, it is no criterion as between different styles of boilers—a square foot under some circumstances being many times as efficient as in others; but when the average rate of evaporation has been fixed upon by experiments in one boiler, there is no more convenient way of rating others of the same style. But by an outsider no exact rating of a boiler can be made from a knowledge of only its heating surface.

The following rules are observed in a good many boiler shops, and may be useful: For cylinder boilers nine square feet of heating surface per horse power are allowed, for flue boilers twelve square feet, and for tubular boilers fifteen square feet of heating surface per horse power. Hence, if the total heating surface be known, divide it by 9, 12, or 15, according to the type of boiler, and the quotient will be the horse power of the boiler. If a boiler is tested and a statement of its horse power desired, without regard to whether it is to supply its steam to drive an engine or for other purposes, then it is agreed upon by the majority of experts to consider 30 pounds of water per hour, evaporated at 70 pounds pressure from 100 degrees, as a horse power.

A standard was fixed by Watt at one cubic foot of water evaporated per hour from 212 degrees for each horse power. This was at that time the requirement of the best engine in use. Most nations have a standard similar to and generally derived from Watt's "horse power," but owing to different standards of weights and measures these are not identical, though the greatest differences amount to less than 1½ per cent.—*Electrical Age.*

To make glue water proof, dissolve of gum sandarac and mastic each five and one-half drachms in one-half pint of alcohol, and add five and one-half drachms of turpentine. Place the solution in a glue boiler over the fire and gradually stir into it an equal quantity of a strong hot solution of glue and isinglass; strain, while hot, through a cloth. Or to plain glue solution add bichromate of potash; on exposure to the air it becomes waterproof.

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RECENTLY PATENTED INVENTIONS.

Mechanical.

WRENCH.—John H. Gregory, Ione, Cal. This is an improvement in wrenches having a fixed jaw and another jaw to slide on the toothed shank, a pivoted cam lever locking the wrench to any desired adjustment. The outer jaw has a triangular hook-like shape, while the inner jaw is somewhat curved, both jaws having toothed surfaces, and the outward movement of the sliding jaw is controlled by a spring secured to the forward edge of the sliding bar, the spring holding the jaw in engagement with the pipe or other object to which the wrench is applied, an inclined wall or shoulder also supporting the sliding jaw when the latter is pressed down against it.

GUIDE HOLDER FOR STAMP MILLS.—Peter C. Robertson, Phillipsburg, Montana. In mills for crushing ores the vertically reciprocating stamps are guided by holders or boxes secured to the rails of the frame of the battery of stamps, and this invention provides for a series of guides being conveniently applied to a series of stamps to hold them so that they will reciprocate easily, without undue friction. They are so arranged that any guide and its holder may be easily removed when necessary, or tightened to force the back and front portions of the boxes to an even pressure. After the guides and holders are once in place, any single holder and guide may be conveniently removed when desired.

BUILDERS' SCAFFOLD.—Louis Korn, New York City. This device consists of a bracket having a body portion to rest on a window sill, there being at one end a lateral projection and a pivoted depending arm, and at the other end a pivoted vertical post with a hook or brace to detachably engage the body portion. A diagonal brace is pivotally secured to the under side of the body, its inner end designed to rest against a building wall, and a short slotted brace pivotally connects the diagonal brace with the body. The apparatus may be folded to be conveniently portable, and affords a scaffold especially applicable for building a blank wall, giving a secure support for the workmen.

LUBRICATOR.—Henry E. Lejeune, Thibodeaux, La. A device more especially designed for use on the water cylinders of vacuum or other pumps to automatically oil the cylinders is provided by this invention. The invention consists of a lubricant reservoir having at its lower end outlets leading to the ends of the cylinder to be oiled, glass tubes connected with the outlets leading to the cylinder ends, while a valved water chamber is held on the under side of the reservoir. The amount of oil flowing to the ends of the cylinder can be plainly seen and readily regulated.

SKIVING MACHINE.—Herbert Masterson, Jefferson City, Mo. A reciprocating slide moves above a vertical open topped holder, there being a knife beneath the slide and a carrying form held in it, while vertically movable brads in the form engage the pieces of leather in the holder. The machine is designed to skive the shanks, counters, and other pieces of boots and shoes, a number of the pieces to be skived being placed in the holder, and the machine then working positively to automatically skive them one by one and dropping them out of the machine at the rear.

JACQUARD CARD WIRE.—Alfred and Thomas W. Bentley, Paterson, N. J. A wire extending between adjacent cards is formed with flattened parts, tying strings engaging the wires at such portions, and also the laces connecting the cards with each other. A lateral shifting of the wire is prevented, the ends always projecting like distances from the ends of the cards for suspending the latter in the usual way.

Miscellaneous.

CALENDAR.—Joseph Wallin, Boston, Mass. Three dials having ratchet wheels expose indications on their faces, a pull bar in the case engaging two ratchet wheels to move two of the dials, and rotate the other dial and its ratchet wheel, when laterally swung below the lower end of the case and then reciprocated. The invention also embraces other novel features, the calendar being adapted for perpetual use, indicating the name and date of days in a week and month in chronological order.

SAFETY DEVICE FOR ELEVATORS.—Louis W. Butler, Brooklyn, N. Y. This is a simple and easily applied attachment for use in connection with any form of elevator valve rope, utilizing electricity to move out of the path of the valve rope a keeper capable of preventing movement of the rope. The keeper is carried from the path of the valve rope the moment the doors of the elevator shaft are closed, and when any door is opened the keeper is drawn into the path of the rope, preventing the rope from being operated to start the car until the door has been closed.

TO REMOVE PAINT OR VARNISH.—George L. Ball, Allegheny, Pa. This is a composition to be applied by a brush upon varnished or painted surfaces to remove a former coating, speedily rendering hard paint or varnish soft and detaching it from the wood or metal on which it had dried. The composition does not discolor the surface to which it is applied, which can be varnished upon as soon as dry.

EXTENSION TABLE.—Johann F. Wiggers, Hanover, Germany. The extensible parts of this table may be collapsed or withdrawn and firmly erected without the aid of screws, wedges, etc. The main table has a central cross piece provided with vertically spaced lateral projections, fixed guides and supports leading to the projections from the end pieces of the main table frame, the guides being inclined, while extension leaves having folding legs are guided by the supports and rest thereon when in the inner positions.

SLATE ATTACHMENT.—Maud Wyman, San Francisco, Cal. Lettered bands, according to this invention, run beneath the slate and under slots in its frame, and also over a part of the frame, so that any letter or character on the band may be disclosed. The bands pass over spools on a fixed shaft, each spool having a projecting milled edge, by which it may be rotated and the band drawn along to disclose a desired letter or character. A tension spring counteracts shrinking and stretching of the bands, and assists to hold them in proper position.

BUGGY TOP.—David Shivell, Arlington, Ind. This is an improved top of simple construction, provided with movable curtains, arranged to be conveniently operated to close the sides. Rods are curved to conform to the shape of the top part of the bows, and curtains fitted to slide at their upper ends on these rods are fastened at their lower ends to the sides of the buggy, the side curtains when not in use resting between the cover and lining. The curtains readily fold with the bows when the top folds, whether they are in a lower or upper position.

VEHICLE BODY SHIFTING DEVICE.—Charles H. Mitchell, Oxford, Ohio. The front or rear portion of a vehicle body is designed to be shifted laterally upon the axle by means of this improvement. The invention also provides a simple device for connecting the body with the front axle of a thrashing machine, separator, steam stacker, or other agricultural implement driven by steam, by which the implement may be adjusted as desired with relation to the driving pulley of the engine.

MANURE DISTRIBUTOR.—Robert J. Morris and Robert L. Wiggins, Alexanderville, Ga. This is a machine for hauling and drilling in furrows cotton seed compost, or stable manure in the rough or pulverized state, and also guano or commercial fertilizers at the same time. The machine is designed to supply the place of a cart for transporting it to the field, and also act as a distributer to place the manure in a furrow without dropping it in heaps, and without transfer of bulk from one vehicle to another.

COCKLE SEPARATOR.—Andrew G. Miller, Estill Springs, Tenn. This is a machine to separate cockle from wheat, oats, rye, etc., the material being fed into a vibrator box in which travels a separator formed of metallic plates covered with depressions, the ptates being secured at opposite edges to endless leather belts. The wheat or other grain becomes seated in the depressions and is carried to the lower end of the separator while the cockle is carried backward over the receiving end of the box.

STAND FOR BICYCLES.—Herman C. Wiedenmann, Philadelphia, Pa. This is a simple and durable construction readily applied to any bicycle to support it upright and hold the wheels above the ground. The front wheel is engaged by a frame consisting of two standards connected with each other at the top and bottom and formed with forks to receive the hub of the wheel, a transversely adjustable rest on each of the standards engaging the fork, while an independent frame also engages the hub of the rear wheel. When the bicycle is in position on the stand both wheels can be revolved, rendering it convenient to do any desired cleaning or repairing.

CHICKEN BROODER.—Earl Barney, Schenectady, N. Y. This is an improvement on a formerly patented invention of the same inventor, the brooder being heated by lamps and so constructed that none of the vitiated air in the lamp room can get into the brooder. The latter compartment is made evenly warm and well ventilated, and connected with it is a light and airy exercising room for the chickens, to which easy access may be had from the brooder proper.

MOLE TRAP.—George Nelson, Livingston, Texas. This trap has a vertically sliding spring-pressed plunger, carrying impaling devices, a shoulder on the plunger being engaged by a stationary arm of the frame, while a pivoted lever connected with a trigger is adapted to disengage the shoulder. The trap is simple and cheaply made, and easily tripped to transfix a mole or other animal.

DESIGN FOR A FAN.—Manuel Carranza, Havana, Cuba. This design represents the vessels of Columbus' fleet on the discovery voyage, one of the vessels being close at hand and the others at a distance on an expanse of water on the ribs of the fan.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

DIE NEUEREN SCHNELLDAMPFER DER HANDELS- UND KRIEGSMARINE. By Carl Busley. Kiel and Leipzig, Germany: Lipsius & Tischer. 1892. 8vo. Pp. 212. 156 illustrations. Price 5 marks.

This work is well worthy of translation. Though we have two new works on steam navigation, "Ocean Steamships" and the "Ocean Ferry," neither gives the technical details, which are of great interest to persons of a scientific turn of mind. All of the various stages in the evolution of the modern express steamer are given, from the Viking boat of 800 A. D. down to such magnificent floating hotels as the Furst Bismarck. The elevations of the various steamers give a good idea of the various changes. A number of the illustrations show the extremely florid decorations of the German steamers, which are usually in very bad taste. Considerable attention is given to three-screw vessels. This chapter is, without doubt, the most interesting section of the book to the student of marine engineering. The book is well illustrated, and it is unfortunate we have not an equivalent work in the English language.

ANNUAL REPORT OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY. 1892. 8vo. Pp. 473.

There is an amount of useful as well as curious information embalmed in the government publications which are seldom read. The present work is largely devoted to an account of the various river and harbor improvements which are conducted by this department. The most interesting portion of the book is that relating to fortifications, but is unfortunately very brief. It is to be hoped that the time will come when the government will devote more attention to our defenseless coasts than to the improvement of fourth rate rivers.

THE COMPASS. Edited by William Cox. Monthly. New York: Keuffel & Esser Co., publishers. Price $1 per year.

This new publication is worthy of the support of all engineers, surveyors and draughtsmen, as it is devoted entirely to their interests. Though the publication is controlled by a large supply house of instruments, etc., for engineers and draughtsmen, this fact is kept in the background, and all notices of a business nature are confined to the cover. There seems to be a good opportunity for the publishers to open a column for the use of subscribing draughtsmen out of situations, as they have begun answering queries. The recent number contains timely articles upon the pantographs, eccentrolinead, the graphometer, etc. The intelligent draughtsman should not fail to subscribe to this interesting journal.

ORIGINAL PAPERS ON DYNAMO MACHINERY AND ALLIED SUBJECTS. By John Hopkinson. New York: The W. J. Johnston Company, Limited. London: Whittaker & Co. 1893. Pp. 249. No index. Price $1.

Hopkinson's work on the dynamo during the last decade has been of such value that any publication of his investigations is to be welcomed by all. The present little work contains nine papers, reprinted from proceedings of different societies and elsewhere. It is illustrated, but unfortunately lacks an index. It is pleasing to observe in the author's modest preface the appreciation which he expresses for his American readers.

WHERE IS MY DOG? OR, IS MAN ALONE IMMORTAL? By the Rev. Charles Josiah Adams. New York: Fowler & Wells Company, Publishers. 1892. Pp. 202. Price $1.

This work is a plea for the higher intelligence of the lower forms of nature, and will, we have no doubt, prove acceptable reading for those interested in the brute creation.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN

BUILDING EDITION.

JANUARY, 1893, NUMBER.—(No. 87.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing a very attractive dwelling at Bridgeport, Conn., erected at a cost of $15,000 complete. Floor plans and perspective elevations. Joseph W. Northrup, architect, same place.
2. Plate in colors showing a residence at Armory Hill, Springfield, Mass. Two perspective views and floor plans. Mr. Francis R. Allen, architect, Boston, Mass. An excellent design.
3. A cottage at Brookline Hills, Mass., erected at a cost of $4,825 complete. Perspective views and floor plans. Messrs. Sheply, Rutan & Coolidge, architects, Boston. A picturesque design.
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6. A residence recently erected at Plainfield, N. J., at a cost of $9,175 complete. A picturesque design. Two perspective elevations and floor plans. Messrs. Rossiter & Wright, architects, New York.
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8. A substantial residence at Holyoke, Mass. Perspective elevation and floor plans. Mr. H. H. Gridley, architect, Springfield, Mass. An excellent design.
9. View of the Union Passenger Station, Worcester, Mass.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(4629) R. R. J., Minn., writes: A certain chief engineer of a railroad in this State having occasion to convey water from a river to a tank one mile distant and about 50 feet above the supply, started with a three inch pipe at the river or supply end, continued ⅛ of the distance and then reduced the pipe to two inches up to ⅜ of the distance, finished with a one inch pipe and connecting with the tank. Now, the question is, Should he not have placed the small end of the pipe at the pump and the large end at the tank? A. The friction will be the same whichever way the pipe is laid. This does not come under the condition of a gravity supply, in which the largest pipe should be placed next to the source of supply. The arrangement as stated is an engineering absurdity. The friction is greater and the pipe line costs more than if 2 inch pipe were laid the whole distance.

(4630) W. B. P.—Dynamite has been used for blowing out stumps. It requires great care to avoid accidents. Quarter and half pound cartridges are used, with electric fuse and battery.

(4631) W. T. B. asks: Will you kindly advise me if it is possible to study electrical engineering and become an electrician without the aid of a teacher, and if so, what books would you advise me to study? A. You can undonbtedly get a good knowledge of electricity by a course of study without the aid of a teacher, but you would progress faster and with more satisfaction if you study under some practical person who is able to show you exactly how the different oparations are carried on. We advise you to begin with "Experimental Science," price $4. This will give you a general knowledge of physics and a very good idea of elementary electricity. You might then take Ayrton's "Practical Electricity," price $2.50, and after mastering this book it would be well for you to study Thompson's "Dynamo Electric Machinery," price $9.

(4632) J. J. M. writes: I am a mechanical engineer. I went on examination as an engineer. One question, with the others, was put to me. It is as follows: Suppose I took charge of a boiler that was running some time, what would be the thickness of the shell of the boiler? The examiner did not say how long the boiler was running. I told him if there was a

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rule to go by, that I never saw or heard of one. A. The question put to you was a very crude one. There is no rule for the wear of boilers, this depending upon the use and abuse of them, as well also as the quality of the metal. The kind of water used is also to be considered. Acidulated water as found in some parts of the country eats away a boiler very fast. Outside rust also thins the sheets and tubes in boilers not in constant use.

(4633) W. W. H. writes: We are putting up a good sized coffee roasting plant and desire to put in a floor, fireproof, that will not break or crack when heavy iron trucks are run over it—something cheap and durable. A. Assuming the floor is on the ground, we recommend a cement concrete not less than 4 inches deep, and on this lay an asphalt and sand floor 1 inch deep. Just enough asphalt to make the sand solid, laid hot.

(4634) A. B. asks how to harden aluminum, sheet and wire, extremely hard and elastic, just like tempered steel? A. Aluminum cannot be tempered like steel. It can only be hardened by hammering, by making a hard alloy, and by slowly cooling. By the slow cooling process springs have been made of pure aluminum. See Richards' work on "Aluminum and its Alloys," $5 mailed.

(4635) J. H. W.—Nut locks have been profitable to a few inventors. There are a large number of patents on this device. The kind mostly in use are very cheap, perhaps 5 cents per pound. A short, quick-running siphon may have the discharge end out of water. Long siphons should always have the end immersed.

(4636) Insects from Flagstaff: Reply by Professor C. V. Riley.—The insects sent comprise a number of specimens of the common cabbage plant louse (*Aphis brassicae*). This species is found upon a number of cruciferous plants, but owing to the fact that it feeds on the underside of the leaves, it is frequently difficult to reach with the ordinary insecticide sprays. The best mixture to use against it is the kerosene soap emulsion, made according to the formula on page 3, of circular No. 1, Division of Entomology, Second Series, published about a year ago in the SCIENTIFIC AMERICAN and a copy of which is sent herewith. The apparatus commonly used in such cases is one of the knapsack pumps fitted with a stiff rod or lance which will reach from the hand of the operator to the ground, and upon the extremity of which is soldered an upturned cyclone nozzle, so that the spray may be thrown easily on the underside of the leaves.

(4637) T. R. B. asks: Which of the metals copper, brass, zinc or galvanized iron will undergo the greatest expansion and contraction in a temperature varying from 125° to 135° Fah.? A. Zinc expands and contracts most of all the common metals, and very evenly between any temperatures below 212°. Brass next, and iron the least of those mentioned.

(4638) J. C. S. asks: Will you tell me about the amount of steam pressure an ordinary glass fruit jar will stand? A. Ten pounds. 2. Can glass receive as high and uniform a polish and surface as lead, copper, zinc or steel? A. Yes.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everyw ere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conductin the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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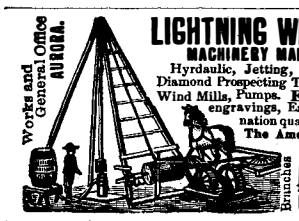

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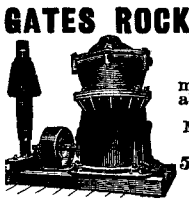

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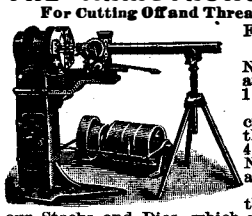

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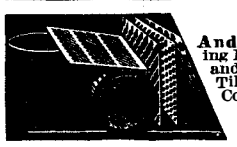

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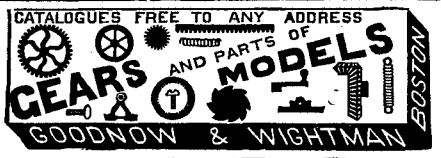

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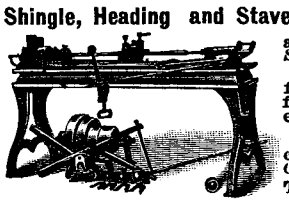

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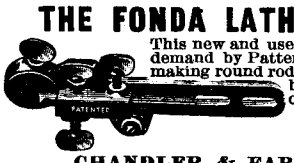

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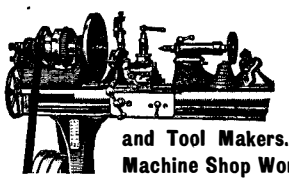

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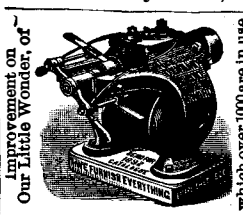

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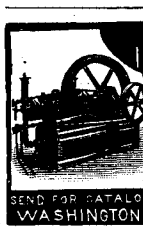

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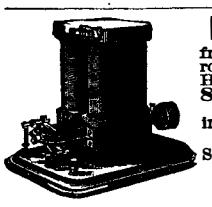

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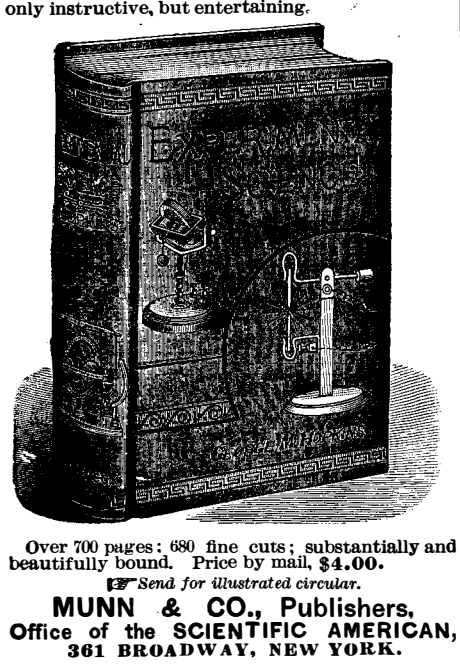

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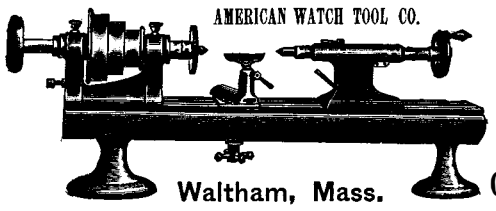

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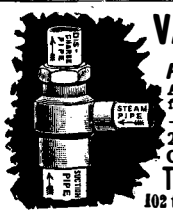

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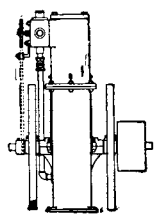

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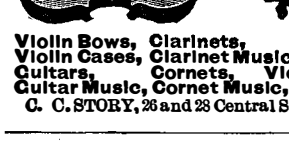

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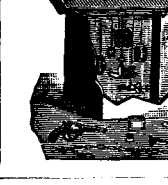

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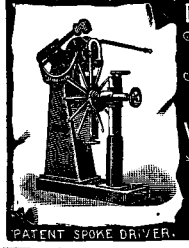

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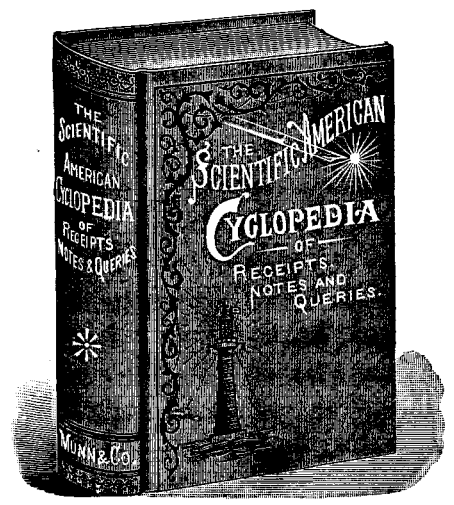
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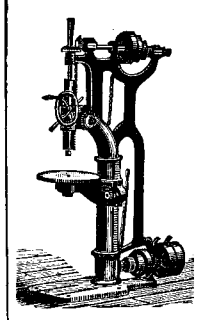

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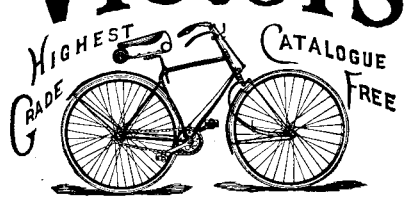
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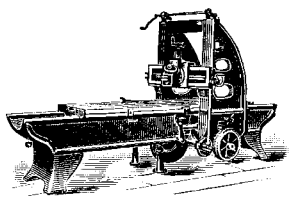

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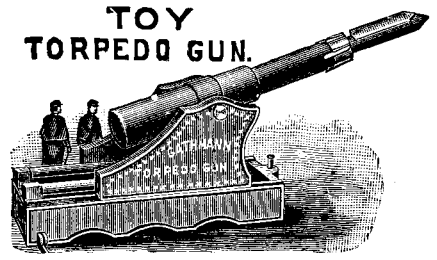
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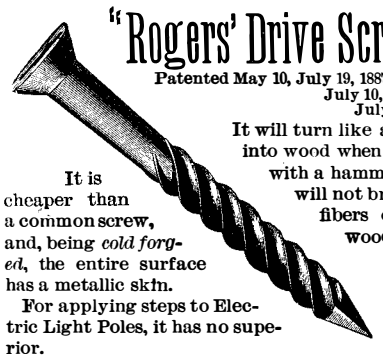
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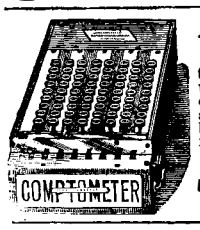

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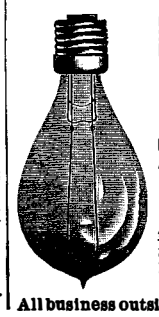
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